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MONTHLY WEATHER REVIEW

DECEMBER 1948

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CORRECTIONS

MONTHLY WEATHER REVIEW, November 1948, vol. 76, "Solar Radiation Data for November 1948," p. 263:

In Table 1, Madison, Wis., move headings 1.92, 2.88, 3.84, and 4.81 one column to right and insert heading *0.96.

In Table 2, value for Washington, D. C., on Nov. 22 should read 25; for East Lansing, Mich., on Nov. 27 should read 46.

MONTHLY WEATHER REVIEW

Editor, James E. Caskey, Jr.

VOL. 76, No. 12
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DECEMBER 1948

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THE WEATHER OF 1948 IN THE UNITED STATES

L. H. SEAMON

[Weather Bureau, Washington, D. C.]

The weather of 1948 generally was very favorable for agriculture. The total production and yield of corn was the highest of record. Yields of most other major crops were high and production above average. The near-record wheat production, exceeded only in 1947, was somewhat remarkable in view of the 1947 fall drought in the Great Plains winter Wheat Belt that seriously delayed seeding and prevented germination and normal growth. Moisture conditions began to improve during the latter part of November 1947 and seeding continued well into December. However, twice the normal precipitation during December 1947, and above normal temperatures which continued until the middle of January allowed the late seedings to make rapid progress. Weather conditions were again favorable when a mostly adequate snow cover furnished protection against the severe winter cold. A spring drought for a time threatened the crop but abundant rains and favorable temperatures during late April continued until maturity, resulting in yields far beyond expectations. These conditions were very favorable also for seeding the spring wheat crop and the corn crop. In fact nearly ideal weather conditions continued in the Corn Belt until late August when a heat wave may have limited production locally. Moisture and temperature conditions also favored soybeans and cotton.

An extensive cold wave at the end of January injured citrus, especially grapefruit in southern Arizona, and vegetables in southern California and Texas, and a freeze killed much tender truck in Florida on January 15. A record cold wave about the middle of March caused considerable damage to truck in the West Gulf area and the lower Mississippi Valley.

In late March and during April rains and melting snow caused considerable flooding in north-central and northeastern areas, and heavy rains caused floods in the Ohio Valley in late April. During May and June occurred the disastrous floods in the Northwest, affecting Washington, Oregon, northern Idaho, and western Montana. In May, June, and July unprecedented rains caused many flash floods in the lower Great Plains. During December a damaging flood occurred in the Willamette Valley of Oregon.

Local storm damage was unusually heavy in the latter part of March, and hailstorms were very numerous in central sections during the summer months. A record heat wave spread over the Northeast during the last week of August, after which no unusual weather occurred until late November when one of the most severe early season snowstorms of record, with near blizzard conditions, caused considerable damage and suffering in portions of the central Great Plains.

Much-above normal temperatures continuing through December east of the Appalachians have rarely been exceeded; and the almost total lack of snow cover in New York and New England during the month was most unusual.

Severe local storm losses for 1948 were very high. Tornado damage totaled nearly $54,000,000, or more than 4 times the annual average amount. Wind storms, other than hurricane and tornado, hail, snow, and glaze storms accounted for many millions more. Hurricane losses of $18,400,000 however, were low having been exceeded many times in past years. (See articles on hurricanes and tornadoes elsewhere in this issue and tables of "Severe Local Storms" in each issue of the MONTHLY WEATHER REVIEW for 1948.)

The monthly and annual State temperature departures are shown by Table I; percentage of normal precipitation for months and the year by Table II; monthly and annual precipitation by Table III; and annual temperature anomalies and percentage of normal annual precipitation for 1948 by charts following this article.

January—Temperatures during January averaged from slightly above to much above normal in the Mountain and Pacific States, Nebraska, and the Dakotas, while they ranged from slightly to considerably below their usual values in the remainder of the country. The greatest plus departures were recorded in the middle and eastern portions of Montana and in the western Dakotas, with a plus departure of 14.5° at Havre, Mont. The greatest temperature deficiencies for the month were accumulated in the eastern portions of the Middle Atlantic States, the Ohio Valley, and the Central Gulf region, ranging from 6° to more than 8° below normal.

The first half of the month was unusually warm throughout the country, with daily plus departures exceeding 25° on a few days in some eastern sections. However, this period of warm weather was occasionally interrupted by cold waves, two of which brought below-freezing temperatures to northern Florida and deep into Texas.

The first cold wave was preceded by a severe storm which swept through middle and northeastern sections on the first 2 days of the year. While no extremely low temperatures were recorded the storm was accompanied by a great variety of intense weather conditions. Severe icing occurred over large areas, especially in Oklahoma, Missouri, Iowa, Michigan, Indiana, Ohio, and Pennsylvania, damaging power and communication lines and creating hazardous travel conditions. Accompanying high winds, a maximum velocity of near 100 m. p. h. being recorded at the Glenview Naval Air Station north of Chicago, added to the damage. The freezing rain was

followed by over a foot of snow in portions of Missouri, Iowa, and Wisconsin, delaying and in some cases halting transportation. Heavy rains in the southern portion of the storm track, with maximum 24-hour amounts exceeding 3 inches at many stations in the Ohio Valley, caused streams to overflow in West Virginia, Ohio, and Indiana. Tornadoes were reported from several midwestern and southern States, the most destructive occurring in northwestern Louisiana. Total losses due to this storm were tremendous; damage resulting from high winds and icing in Illinois alone was believed to approach $3,000,000.

The warm weather east of the Rockies was brought to an end on the 15th–16th by a severe cold wave, accompanied by blizzard conditions in parts of Minnesota and North Dakota, which brought below-freezing minima to all southern areas except extreme southern Texas and Florida, and below-zero minima to northern areas. With another inflow of cold air from the North on the 18th, temperatures again fell below freezing to the Gulf of Mexico and zero minima were recorded as far south as Nashville, Tenn. The lowest temperatures of the winter in portions of the Lake region were recorded during this cold wave; Cadillac, Mich. reported a low of −37° and Moose Lake, Minn., −47°. Snow covered large areas of the South, measuring a foot in depth in portions of northeastern Mississippi and western Tennessee.

The continued inflow of cold air into sections east of the Rockies prolonged the severe cold weather through the remainder of the month. Warm weather continued in the Mountain and Pacific States until the closing week, resulting in the warmest January in many years in portions of that region, and equalling or breaking January maximum temperature records at a number of stations. The frigid air, which overspread this region during the last week, brought extremely low minima to many stations; −48° at West Yellowstone, Mont. and Bondurant, Wyo.; −6°, a new all-time low record, at El Paso, Tex., on the 28th, and −29° at Denver, Colo. Blizzard conditions prevailed in New Mexico on the 25th. Frosts damaged vegetables and citrus in southern Arizona and California.

Attesting to the continuous low temperatures in the East was the fact that rivers were frozen over as far south as the Ohio Valley, and minor streams were frozen in northern portions of the southern States. Navigation was halted in the upper Ohio on January 24.

January was a dry month. Precipitation was heavier than usual in Florida and along the Gulf and Atlantic coasts, and slightly above normal in a belt extending from the Texas Panhandle to northern Idaho, and thence southwestward to the Pacific coast, including most of Oregon; elsewhere, it was deficient. Most precipitation in the Far West fell during the first decade.

Drought conditions prevailed in Nevada, southern California, and western Arizona. Drought and high temperatures resulted in a below-normal mountain snowpack. Most mountain stations received less than one-half their normal snowfall. In California, for instance, the mountain snow cover was only 12 percent of normal at the end of the month.

Most precipitation east of the Rockies was in the form of snow, and most States, except those in north-central areas, received a much above-normal fall. Periods of heavy snowfall occurred on 17th–18th, 23d–24th, and 31st. The total snowfall for West Virginia was the greatest since 1918. On the 24th, 17 inches of snow fell at Youngstown, Ohio, and more than a foot in 24 hours was recorded at 16 stations in Pennsylvania. On the 25th Boston, Mass., measured 22.1 inches on the ground, a record exceeded only once.

February—The severe cold weather experienced during the latter part of January continued unabated through the first half of February. The latter half, however, was generally mild, except for abnormally cold weather in the extreme Southwest during the closing week. Monthly temperatures averaged colder than usual in New England, portions of the Middle Atlantic States, and generally from the Great Plains to the Pacific coast, although averages at a few stations in northern Oregon and Montana, and near the Great Salt Lake were somewhat above normal. In other areas, warm weather during the latter half more than overcame the deficiency for the first half and averages were somewhat above normal.

Precipitation averaged below normal in the North Atlantic coastal States, Michigan, California and Nevada, and above normal in all others. Arizona and North Dakota received more than twice their usual amounts while California received 50 percent of normal and Florida only 33 percent. The greatest excesses occurred in a belt extending from eastern Oklahoma to eastern Tennessee, and in the northern portion of Washington west of the Cascades. The greatest monthly totals exceeded 20 inches in Washington and 15 inches in Tennessee.

Several cold waves were experienced in north-central areas. In a few instances they pushed far southward bringing frost and below-freezing temperatures deep into the South. The most severe of these occurred early in the second decade. Blizzard conditions, which preceded this cold air mass as it spread southward from the northern Rockies, reached their greatest intensity on the 11th in a large area centered about the Texas and Oklahoma Panhandles. On the following day, subzero temperatures were recorded in every western State, many stations experiencing their lowest of the month and a few the lowest of the winter. A low reading of −28° at Alpine, Ariz., on the 12th was within 1° of the all-time record low for the State. Utah recorded its lowest temperature of the winter on the same date, when the mercury fell to −40° at Woodruff. At Pueblo, Colo., on the 13th, a maximum temperature of 46° and a low of −16° gave an extreme range of 62°. Frost occurred in the border regions from Texas to California and seriously damaged citrus in the Phoenix, Ariz. area.

Total snowfall was above normal in most states east of the Continental Divide and generally about normal in other States, except below in California. A total of 16 inches of snow, which fell in 20 hours at The Dalles, Oreg., on the 5th and 6th, was very unusual for that vicinity. Precipitation was frequent during the first half of the month and nearly all in the form of snow except in extreme southern areas. A storm moving along the northern border near the end of the third week brought light to heavy snow to the northeastern part of the country, and blizzard conditions to central and eastern North Dakota. The average total snowfall in North Dakota was only one-tenth of an inch less than the record fall of 12.8 inches in February 1922. Warm weather, however, melted the snow at middle and southern latitudes east of the Rockies during the latter half of the month and by March 1 the ground was generally bare south of New York and the Great Lakes and south of Iowa and Kansas. In most areas, however, small grains were adequately protected by snow during the period of extreme cold.

Glaze or ice storms were numerous and widespread but generally caused only minor damage and the usual inconveniences such as slowing of traffic and minor accidents. The greatest damage caused by these storms occurred in Aberdeen, Miss., on the 8th and 9th and in central Minnesota and southeastern South Dakota on the 27th

and 28th. After the middle of the month, melting snow and ice, together with heavy rains, caused minor floods in many sections.

March—Average temperatures were above normal east of the Mississippi River except in Maine and Wisconsin; and below normal west of that river except in Louisiana. The greatest excesses, 6°, were accumulated in the Appalachian region, and the greatest deficiencies, 8°, occurred in southern Colorado and southwestern Kansas.

Like February the first half of March, except for the opening days, was very cold and the latter half warm. This contrast was greatest at a number of stations in the Central Great Plains where the range between the average departures from normal for the first and last weeks of the month was nearly 30°. However, temperatures were rather persistently below normal throughout the month in most areas west of the Continental Divide, and mostly continuously above normal in Atlantic coastal areas south of New England.

Monthly totals of precipitation were below normal in extensive areas of the northern Great Plains and northern Rocky Mountain region, and in a belt extending along the southern extremities of the country from northern and western Louisiana to the Pacific coast. Totals were slightly deficient in the extreme northeastern part of the country and extreme western Washington. Large excesses were recorded in Central Gulf and southeastern areas, with an exceptional accumulation of 15 inches above normal in southeastern Louisiana. Although the first half of March was wet due to frequent and widespread precipitation, amounts were generally light and accumulations below normal.

After the first few days a cold wave preceded by widespread precipitation rapidly overspread practically the entire country, bringing subzero minima southward through the Rockies to New Mexico and to the Canadian Border States east of the Rockies. Below-freezing minima were reported everywhere, except along the Pacific and Gulf coasts and in the extreme southeast.

As this cold air moved into the Gulf, a depression developed and, attended by excessive precipitation, moved rapidly northward to the Dakotas. Twenty-four-hour rainfall at central Gulf stations ranged up to more than 10 inches. The rain turned to snow farther north, blanketing the Central Plains with deep snows which established new records for depths on the ground in southeastern Nebraska and portions of Kansas and Iowa.

Cold arctic air continued to flow southward from Canada, reaching its peak about March 9 to 12. This cold wave moved southward through the Great Plains with such rapidity that there was little time for the usual moderation before reaching southern sections, and it was here that extremes of temperature reached their greatest departure from normal. March low temperature records, however, were broken at many stations in the areas north of the Ohio River and from the Rockies to the Mississippi River. New all-time State low temperature records for March were set in Arizona, New Mexico, Kansas, Arkansas, Missouri, Iowa, Indiana, and Ohio; were equaled in Colorado, Texas and Oklahoma; and came within 5° or less of equaling the record in Illinois, Wisconsin, Michigan, Minnesota, South Dakota, and Montana. Freezing temperatures were recorded in Brownsville, Tex., and snow fell in the Rio Grande Valley. Considering the great area covered, and the number of record low temperatures established this probably rates as the most severe March cold wave of record.

While the last half of the month was marked by changeable conditions, temperatures and precipitation generally averaged above normal. On the 19th a storm accompanied by excessive precipitation and high winds moved from the central Great Plains to the Lake region. The course of this storm was marked by no fewer than a score of tornadoes, the most severe occurring in Bunker Hill, Ill., and vicinity, killing 24 persons, injuring 295, and causing about $3,000,000 damage. High winds, with gusts up to 100 m. p. h. caused an estimated $4,000,000 damages in Indiana, many millions in Ohio, and about $750,000 in New York. Total tornado and wind damage resulting from this storm probably exceeded $10,000,000.

On the 20th the most destructive tornado ever noted in Oklahoma caused over $10,000,000 damage at Will Rogers and Tinker air fields near Oklahoma City, Okla. In less than a week a second tornado struck Tinker Field, causing damage exceeding $6,000,000.

On the 26th and 27th another storm swept through the central portion of the country, accompanied by damaging winds and heavy precipitation. Tornadoes and hailstorms were reported from a number of States, and sleet, freezing rain, and heavy snows occurred in north-central areas. Total damage from this storm was several million dollars. Total storm damage for March was unusually high, between $30,000,000 and $40,000,000 with tornado damage alone exceeding $28,000,000.

Several damaging floods occurred during the latter part of the month due to heavy rains, melting snows, and ice jams. One of the most severe caused over $1,000,000 damage in southern Michigan. High water at Towanda, Wilkes-Barre, and Danville, Pa., on the 23d and 24th caused considerable damage, drove hundreds of families from their homes, and idled several thousand coal miners temporarily.

April—Temperatures averaged above normal during this month except in the Pacific Northwest, northern California, the northern Great Basin of the far West, northern Montana, and North Dakota. Plus departures for the month exceeded 8°, in the central and lower Great Plains, while deficiencies of 4° and over occurred in northern California and eastern Washington. Precipitation was mostly above normal in California, Florida, and in northern portions of the country, except New England, Wisconsin, and Montana, and generally below elsewhere. In California, above-normal precipitation during the last 2 months after more than a year of relatively dry weather, improved the water outlook considerably. This was the warmest and one of the driest Aprils of record in Kansas and the driest of record in Missouri.

The first week was warmer than usual east of the Rockies and in the Southwest, but rather cool in the Northwest. Typical of spring, conditions were changeable, with shower-type precipitation, fluctuating temperatures, and strong winds associated with much frontal activity. Heavy rains fell from Alabama to New England. In the Tallahassee area, 7 inches of rain in 2 days flooded roads. Dust storms were reported from the Great Plains. Damaging frosts occurred in the southern Rocky Mountain States, Midwest, Appalachian region, and in Atlantic coastal areas as far south as Virginia.

The second week was warm in the East and South, but cool in the Northwest. Heaviest precipitation occurred between the Mississippi and the Appalachians below the Lake Region. Dry, windy weather caused some soil erosion in the Southwest and lower Great Plains. Heavy snows and blizzard conditions were reported from northern North Dakota.

The third week was generally unseasonably warm, with plus departures averaging 9° to 12° in the central Great Plains, but in most of New England and the Middle

Atlantic States temperatures averaged somewhat below normal. Precipitation was above normal in the Appalachian region and Atlantic and Gulf coastal States. The Great Plains were again dry and windy. The Ohio River and many of its tributaries overflowed during the week, and the Red River in the North reached the highest stage in many years due to the melting of a heavy snow cover. There was also some flooding in Mississippi and northern Florida. Below-freezing minima and frosts occurred in Virginia and the Ohio Valley.

The last 10 days of the month were very warm, except in the extreme Northwest, with temperatures averaging 9° to 12° above normal in the Ohio Valley and Lake Region. Precipitation was generally below normal, except in the northern and eastern portions of the Great Plains. High winds with occasional soil blowing continued in the Southwest. The month was generally favorable for agriculture.

The most destructive storm of the month occurred in the southern portion of the San Joaquin Valley of California, where wind, dust, and rain caused about $8,000,000 damage to crops and $2,000,000 to property. A severe hail storm in Union, Ouachita, Calhoun, and Bradley Counties, Ark., on the afternoon of the 8th resulted in a loss of more than a million dollars; some hailstones of 3½ inches in diameter by actual measurement were reported.

May—In California and the Northeast and Northwest, the month was wet and relatively cold. The same was true in north-central regions during the first half, but the latter half was warm and sunny. These conditions, especially the abundant moisture, were mostly favorable for agriculture in Pacific States, but delayed planting and growing of crops in Idaho, western Montana, and New England. The cold, damp weather was also detrimental to livestock, especially to new shorn sheep in the Rocky Mountain States. Some late season frosts occurred but damage, other than in local areas, was confined mostly to soft fruit in the Pacific Northwest.

May temperatures averaged below normal in the Midwest, Lake Region, northeastern sections, and generally west of the 115th parallel, except along the north Pacific coast; elsewhere, temperatures were near to somewhat above normal. Record maximum temperatures were reported in North Dakota on the 18th and 19th and in coastal areas in the Middle Atlantic States on the 11th and 12th. The 100° maximum at Fort Laramie, Wyo., on the 22d was within 1° of the all-time May record for the State.

Precipitation averaged above normal in the Pacific Northwest, the lower Lake Region, the eastern coastal States except Florida, and in a belt extending from Louisiana to northern New Mexico and southeastern Colorado. Unusually heavy monthly totals were recorded in Washington, Oklahoma, Maryland, and Delaware, exceeding 15 inches at a number of stations. It was the wettest May of record in Washington and Delaware, and the second wettest in Maryland. In Oklahoma, extremely heavy amounts fell in the south-central and southeastern portions, but the average for the State was normal.

A great reserve of water in the form of a moderately heavy snow cover in the Northwest was rapidly released during the latter part of the month by a sudden change to high temperatures, and increased by heavy rains. This resulted in serious floods, some of which were the most devastating of record. High stages were reached along the Columbia River and its tributaries and most major streams in northern Idaho and Western Montana. An undetermined number of lives were lost, thousands of homes and thousands of acres of crops were destroyed, and a great amount of other property damaged. Damage estimates have not been completed, but preliminary estimates of $3,000,000 in western Montana, over $7,000,000 in northern Idaho, $21,500,000 near Portland, Oreg., would indicate a total of many millions.

Many severe storms occurred during the month, with total damage of at least $15,000,000, tornado damage alone totalling $5,500,000.

June—This month was somewhat warmer than usual in most areas, although slight temperature deficiencies occurred in New England, New York, sections of the North-Central States, and in a considerable portion of the Southwest. Temperatures were continuously above normal in most Southern States and along the north Pacific coast, where the plus departures generally averaged 3° or more for the month. The month was cool in the northern half of the country, with some damaging frost in north-central Wisconsin on the 15th, and a low temperature of 32° at Phillipsburg, Pa., on the 17th.

Precipitation was below normal in the South and Southeast, New England, the lower Ohio Valley, most of the Lake Region, along the coast of Washington and central California, and in northern North Dakota; elsewhere, monthly totals were above normal. As is usual in June, most precipitation was of the thunderstorm type, with large local variations in the monthly totals. Some unusually heavy rains fell in the lower Great Plains during the latter part of the month. One of these occurrences in Nebraska on 21st–22d resulted in flood damage estimated at more than $4,000,000. Many stations in south-central and southeastern Kansas recorded monthly totals of more than 10 inches, with a total of 17.38 at Pittsburgh which was one of the greatest ever recorded in this State. During the period from the 20th to the 24th, torrential downpours occurred in various parts of Oklahoma, with 24-hour amounts ranging from 5 to more than 13 inches officially and much greater amounts unofficially. This resulted in loss of several lives from floods and damage that a partial preliminary survey estimated at more than $4,000,000. According to a survey of unofficial measurements, excessive rainfall up to more than 2 feet fell in a considerable area near Del Rio, Tex., on June 24th.

The Columbia River remained at high flood stages during the first half of June, adding to the damage incurred during the latter part of May. Besides a considerable loss of life, a preliminary estimate of property damage indicated a total of more than a hundred million dollars, making this the most disasterous flood in the history of the Northwest. Heavy rains in northern Idaho and western Montana caused further flooding, which resulted in several hundred thousand dollars additional damage to that of May.

Heavy rains during the latter part of the month were welcomed in some areas. An acute drought was partially relieved in southeastern Louisiana, while lesser droughts in Minnesota, Illinois, and parts of many nearby States were broken.

June had more than the usual number of storms, with total losses running into the millions, but fortunately, the loss of life was relatively small. A few of the greater losses were $2,000,000 from rain and hail in Douglass County, Wash., on the 10th; $4,500,000 from hail and wind in Cheyenne County, Kans., on the 13th; $2,175,000 from wind, hail, and lightning in 3 Kansas counties on the 15th; and $2,400,000 from hail and wind in Redwillow County, Nebr., on the 21st. Total storm damage in Nebraska alone exceeded $7,500,000. Tornado damage for the country exceeded $3,500,000 during June.

The month was generally favorable for agriculture. By the end of the month, temperatures were favorable and moisture adequate for rapid growth of nearly all crops.

July—Temperatures generally averaged only slightly higher than usual during July over most of the country, but were below normal in the Pacific Northwest and at a few stations in the extreme Southeast. In the Northwest, the coldest area in the country during the month, the second lowest July temperature of record for Montana was recorded at West Yellowstone on the 18th. Snow fell in the high mountains of Idaho on the 27th, and frost occurred at high elevations in Utah and southeastern Idaho on the 28th.

Precipitation was extremely light in California, much of the Great Basin, and the central Rocky Mountain region, and was below normal in most of the Southwest, Lake Region, lower Missisippi Valley, extreme northeastern areas, and in the Carolinas. It was much wetter than usual in the Pacific Northwest, the Ohio and upper Mississippi Valley, the Appalachian region, most of the extreme southeastern portion of the country, and in sections of the central and northern Great Plains.

This was the wettest July of record in Kansas, the second wettest in Washington, and the fourth wettest in Oregon and Illinois. A monthly total rainfall of 15.79 inches recorded at Erie, Kans., exceeded the near record total for this State accumulated during the preceding month of June. The unusually heavy rains in this State caused many rivers to overflow, reaching record-breaking stages at some points. Preliminary estimates indicated losses of more than $13,000,000, more than half to growing crops. An unusual flash flood occurred along the Hocking River in Ohio on the 22d when more than 10 inches of rain fell over a considerable area in about 3 hours; total damage was estimated at about $2,000,000.

Local storms were numerous during July but few were severe and total damage was less than usual. The greatest losses were $1,000,000 from hail in Colorado on the 15th, $250,000 from thunderstorms in Nashville, Tenn., on the 22d, and tornado losses of the same amount in Iowa on the 29th.

The weather was generally favorable for agriculture throughout the month. This was especially true in the Corn Belt where high humidity, ample sunshine, and moisture, combined with normal temperatures, provided ideal growing conditions.

August—This month was relatively cool in the Pacific States, California reporting its coolest August temperature of record. Average temperatures were also below normal at most southern stations east of the Mississippi River, but above normal in most other areas. In north-central sections, the first half of the month was pleasantly cool but the second half was hot. The greatest plus departures for the month occurred in the Canadian border states east of the Rockies, due in large part to an intense heat wave which overspread the northeastern quarter of the country during the last week. The great intensity of the hot weather over the Lake region and the Middle Atlantic and New England States was the outstanding feature of the month's weather. New high temperature records were set at many stations in these regions. A maximum temperature of 107° at Mather, Wis., on the 24th equalled the State record for August. Block Island, R. I., and Nantucket, Mass. established new all time maxima of 95°.

Precipitation was very irregularly distributed, especially east of the Rocky Mountains. In general, monthly totals were slightly deficient in most areas of the Southwest and east of the Mississippi River, and above normal in the central and northern Great Plains and the Rocky Mountain and Pacific States. Floods in southern and western Kansas, resulting from extremely heavy rains, caused an estimated damage of nearly $1,000,000. Some damage resulted from flash floods in northern Arizona.

Total damage by numerous severe local storms reached many millions of dollars. Hail was the most destructive element. Several hailstorms occurred in portions of northern Illinois on the 17th, causing damage of $3,000,000 or more. Total hail damage in Montana was estimated at $7,500,000.

The month's weather was fairly favorable for agriculture. While hot, dry weather may have limited corn yields to some extent locally, it favored rapid maturity before frost. Conditions also favored cotton generally, although rains delayed picking in some areas. Late growing crops and fall seeding progressed rapidly.

September.—Average temperatures for September were generally above normal, except in South Carolina, Georgia, and a belt along the Gulf coast from northwestern Florida to the southern half of Texas. The plus anomalies exceeded 6° at many stations in the north-central interior. The month was dry generally, although there were a few scattered areas in the South, in eastern portions of South Dakota and Nebraska, and an area in the Northwest including Washington and Western Oregon, which received more than the usual amount. The greatest excesses occurred in the extreme southern portions of Louisiana, Mississippi, Alabama, and Florida.

The first week was unusually warm west of the Rockies, but unseasonably cold in the Middle Atlantic and New England States and portions of the Lake region. Precipitation was negligible from the Great Plains to the Pacific coast, while amounts in the remainder of the country were irregularly, distributed ranging from none to much above normal. Two hurricanes were noted during the first week, and much of the month's heavy rainfall was associated with them. The first one did not move inland but skirted the Atlantic coast, resulting in heavy rains from Florida to North Carolina. The second originated in the Gulf, and moved inland over southeastern Louisiana on the 4th, continuing a northerly course through western Mississippi and Tennessee into southern Illinois, where it dissipated on the 6th. Accompanying rainfall was especially heavy along its path in southern Louisiana and Mississippi. There was no loss of life attributable to this latter storm, but total damage was estimated at $900,000.

The second week was very warm, especially in north-central, areas where temperatures for the week averaged as much as 15° above normal. Precipitation was generally light, but moderate totals were accumulated in portions of the northern Great Plains, and in scattered areas along the Atlantic and Pacific coasts. Light frosts occurred in portions of the northern Rocky Mountain and North Central States.

The third week was very warm generally. Only in northern California and northern New England were temperatures unseasonably low. Weekly plus departures in north-central areas were again 15° or more. Heavy precipitation was confined to small areas along the Gulf and Pacific coasts, and in northern areas from Minnesota to New England. No more than a trace of precipitation fell in large areas of the Great Plains and Southwest.

From the 15th to the 17th killing frosts occurred in the St. Lawrence Valley and Adirondack section of New York, and at higher elevations and exposed northern areas of New England.

On the 22d a severe hurricane attended by heavy rains and winds of more than 100 m. p. h. near the center moved across southern Florida. Three people lost their lives

and 45 were injured seriously enough to require hospital care. Heavy rains, totaling 10 to 11 inches at some stations, caused considerable flooding in the Lake Okeechobee area. While property loss was not great, crop damage was severe. Total damage was conservatively estimated at $6,500,000.

The last week of the month was unseasonably warm in the Rocky Mountain region and western Great Plains, but temperatures averaged considerably below normal west of this area due to an influx of cool Pacific air, and east of this area due to cold Canadian air which overlay the area most of the week. Precipitation was very light generally, but was heavy in portions of the Southeast. Killing frosts occurred on the 24th and 25th at higher elevations in the Rocky Mountain region and Northeast. The month was generally favorable for harvesting fall crops, except for some delay in the Southeast due to too much rain. Small grain seeding progressed favorably in most areas, but was hampered in the southern portion of the Great Plains by a lack of moisture.

October—Temperatures during the month averaged slightly cooler than usual east of the Mississippi River and warmer than normal west of that stream. Monthly anomalies ranged from minus 3° in Georgia and South Carolina to plus 3° in North Dakota, eastern Montana, and northern Minnesota. The last decade was unseasonably warm, especially in north-central areas, with plus departures averaging 10° to 15°. The month was very dry except at most stations in Oregon, Arizona, Florida, and Virginia. Montana received only 17 percent of the usual October amount.

Below-freezing temperatures and frosts occurred in northern areas west of the Rockies during the first week, but no serious damage resulted as most crops were either harvested or well advanced. Killing frosts were general in most northern regions during the second week, and also occurred in portions of Colorado, Arizona, and New Mexico causing some damage to vegetation in the latter two States. The first general freeze of the season in northern and middle portions of the country occurred from the 16th to 19th, reaching into northern Louisiana and Mississippi more than 3 weeks earlier than usual, for one of the earliest killing frosts of record in those States, but fortunately there was little damage.

A hurricane reached the mainland on the 5th, the center passing over Miami, Fla. Damage was confined to southern Florida and was estimated at $5,500,000, but no fatalities were reported.

A tornado caused $100,000 damage in Florida on the 5th and $180,500 damage resulted from a wind and hail storm in Texas on the 31st. Total losses for the month from storms other than hurricanes amounted to less than one-half million dollars. There were no serious floods.

The month was generally ideal for outdoor work and at the end of the month the harvest of most crops was either complete or well along. Small grains, however, were in need of rain quite generally at the end of the month.

November—Temperatures in the eastern half of the country and extreme north-central areas not only averaged above normal but were almost continuously above during the month. Plus departures in the Lake region and northeastern States averaged about 8°. Temperatures averaged below normal in most of the western portion of the country, although remaining above throughout the second and third decades.

Precipitation was above normal in Washington, western Montana, the Central Rockies, the Mississippi Valley and eastern portions of the country except Florida. The southwestern portion of the country was extremely dry. California, Nevada, Arizona, and New Mexico received less than half of their usual amounts. Arizona received only 2 percent of normal, with many stations in this State and also in southern California receiving no measurable amounts. Monthly totals were several times their usual amounts from Arkansas and Louisiana to the Atlantic coast, due especially to heavy rain during the latter part of the month. Montgomery, Ala., recorded more than 8 inches of rain in 24 hours, and the State average precipitation was 459 percent of normal. Many streams were overflowing in the southern States at the end of the month.

During the first week, several windy days in the Great Plains and far West caused some damage along the northern Oregon coast on the 3d, local damage to California citrus on the 4th, and severe dust storms in western Oklahoma on the 7th. General snowfall, average temperatures near freezing, and accumulation of snow in the Northwest and northern and central Rocky Mountains signaled the approach of winter in the far West.

During the remainder of the month, cold polar air masses, associated with snow and wind, continued to push into the far West bringing subzero temperatures to northern and central portions of the region and occasionally frost and freezing to southern Arizona, New Mexico, and Texas. Near the end of the month, frost occurred in the Rio Grande Valley of Texas as far south as Brownsville, and a low of 25° was recorded at Eagle Pass; tender vegetables were damaged.

From the 17th to 20th one of the most severe early season snow storms of record occurred in the central Great Plains, resulting in millions of dollars damage and a loss of at least 9 lives. The storm was at its worst in western Kansas and Nebraska where a heavy snowfall of 4 to 20 inches, blown by gale force winds into drifts up to 20 feet deep, blocked many railroads and highways, stranded motorists, disrupted communications, isolated many communities, and caused much loss of livestock. The storm was also severe in parts of eastern Colorado, southeastern South Dakota, northwestern Iowa, and extreme southwestern Minnesota. Snow was comparatively light in eastern Colorado, but the high winds caused huge drifts with additional damage to small grains by moving soil. Except for the fact that temperatures were not extremely low, only slightly below freezing, losses and distress might have been much greater.

Severe local storms, other than those mentioned above, were unusually numerous for November, causing much damage and a death toll exceeding a score. Mississippi was the scene of a destructive tornado on the 5th and again on the 18th. Damage from these two storms amounted to $700,000; nine people were killed and more than 60 injured.

Agricultural conditions were generally favorable at the end of the month. Corn and cotton harvests were nearing completion in spite of frequent interruptions and delays due to rains and wet ground. Most miscellaneous crops were harvested in northern areas, and the citrus and vegetable crops were generally satisfactory in southern areas, although tender vegetables suffered some freeze damage in southern Texas. Livestock were in excellent condition in the eastern third of the country due to better than average pasturage, resulting from mild temperatures and abundant moisture; but cold weather caused some shrinkage in Texas and the Rocky Mountains.

December—The average temperature pattern for December was much the same as that for November—cold in the west, warm in the east, with a belt of alternating temperatures in between which averaged about normal. Plus departures were greatest in Montana, ranging from 6° to

9°, while the greatest minus departures of 6° occurred in Florida, extreme southern Texas, and extreme northern Maine. The cold weather was persistent in the far West after the first week, and the unusually mild weather in the East continued without interruption until near the close of the month.

Precipitation was above normal in most States, although Michigan, South Dakota, and several Southern States showed deficiencies ranging from slight to considerable. The State showing the greatest deficiency was Texas, with 37 percent of normal; South Dakota, Kansas, and Oklahoma received only slightly more than one-half their usual amounts. Oregon, with 198 percent of normal, reported the greatest excess.

During the period 3d to 6th, a storm appeared in southern California and as it moved northeastward, developed great intensity over the Great Plains and Lake region. It was accompanied by strong winds and heavy snows in the central Rockies, Utah reporting one of the heaviest snowstorms of record on the 4th, with a December record fall of 11 inches at Salt Lake City. On the 3d and 4th, strong southerly winds preceding this storm caused numerous dust storms in the central and lower Great Plains, and brought record-breaking high temperatures to the Lake region, Fairmont, Minn., recording 66° on the 3d.

The second week brought much snow. The heaviest falls were reported from stations in the northern Cascade and Rocky Mountains. Stampede, Wash., received a total of 53 inches for the week. Moderate amounts fell in Colorado and New Mexico. Light snows were frequent in north-central areas, with weekly totals of more than a foot in northern Minnesota and upper Michigan. Important snowfalls occurred during the 3d week also, with especially heavy amounts in the mountains of California which brightened the prospects for irrigation water. A general snow storm in the Northeast on the 19th deposited more than 19 inches on New York City, for the third greatest fall of record.

Heavy rains in the Southeastern States during the latter part of November caused severe flooding in Mississippi, Oklahoma, and Georgia, and streams were overflowing in coastal regions from Mississippi through Virginia the first week in December. During the second week, heavy rains caused moderate overflow in the Willamette River of Oregon. On the 9th, heavy rainfall occurred at Tallahassee, Fla., and nearby stations with 24-hour amounts exceeding 4 inches.

At the end of the month, small grains were mostly well protected by adequate snow cover in the far West and Great Plains, but the ground was bare in the Northeast and much of the Lake region. However, most crops and livestock were generally satisfactory in eastern areas. Cold weather caused some shrinkage of livestock in the West, and some damage to citrus crops.

TABLE 1—*Monthly and annual temperature departures from the normal for the year, 1948*

State	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Alabama	−6.1	+3.2	+3.8	+4.5	+1.0	+1.2	+0.9	−0.5	−2.2	−2.9	+2.3	+3.4	+0.7
Arizona	+1.4	−2.9	−5.3	+.9	+.8	−.4	+.6	+.4	+1.7	+1.4	−3.6	+.3	−.4
Arkansas	−7.6	−2.1	−1.9	+4.5	−.3	+.7	0	−2.1	−1.7	−2.8	−.4	+1.5	−1.0
California	+3.0	−3.0	−4.2	−2.9	−2.8	−1.2	−2.2	−1.9	0	−.1	−2.1	−4.9	−1.6
Colorado	−1.3	−3.0	−6.6	+2.4	+1.8	−.1	+.3	−.4	+3.6	+.6	−4.5	+.1	−.6
Florida	−2.7	+3.7	+4.4	+3.1	+1.8	+1.1	+.1	−.3	−.3	−1.6	+6.0	+5.8	+1.8
Georgia	−5.6	+2.6	+2.5	+3.5	+.8	+.6	+.1	−1.2	−2.2	−2.9	+4.5	+4.0	+.6
Idaho	+1.5	−.1	−3.6	−1.8	−.3	+2.4	−2.8	−.9	+.6	+.5	−2.9	−6.8	−1.2
Illinois	−5.2	+.4	−.1	+4.6	−1.8	−.2	−.5	0	+1.0	−2.5	+2.7	+2.9	+.1
Indiana	−6.8	+1.0	+1.4	+4.0	−1.5	−.1	−.2	−.2	+.9	−2.9	+3.8	+2.6	+.2
Iowa	−2.3	+.4	−3.2	+5.5	−1.3	−1.1	0	+1.3	+3.6	−1.1	+1.4	+.9	+.4
Kansas	−2.2	−2.4	−6.5	+6.2	+.9	−.2	−1.3	−.7	+2.2	−.6	−1.1	+1.3	−.4
Kentucky	−8.9	+1.7	+3.3	+4.1	+1.2	−.1	+.1	−.9	−.8	−3.7	+3.2	+2.5	+.1
Louisiana	−8.0	−.2	+1.1	+3.5	+1.4	+1.5	+1.9	+.7	−2.1	−2.2	+.5	+3.2	+.1
Maryland-Delaware	−6.5	+.5	+3.5	+1.7	−.3	+.1	0	−.1	−.9	−2.2	+5.3	+2.9	+.4
Michigan	−5.6	−.7	−.6	+4.8	−2.0	−2.0	+.5	+1.4	+3.0	−1.0	+4.9	+2.0	+.4
Minnesota	−3.7	−2.1	−3.5	+2.7	+.5	−1.0	+.8	+1.6	+4.9	+1.4	+2.0	−1.1	+.2
Mississippi	−8.1	−.3	+1.4	+3.4	+.6	+1.4	+1.7	−1.0	−2.7	−2.4	+1.4	+3.4	−.1
Missouri	−5.2	0	−1.5	+5.2	−.5	−.3	−.6	−.4	+1.1	−2.1	+2.1	+2.8	0
Montana	+3.9	−2.3	−4.7	−.5	+1.0	+1.2	−2.2	+.9	+2.9	+1.0	−.2	−5.8	−.6
Nebraska	+.3	−1.1	−4.4	+5.9	+1.4	−.6	−.3	+1.3	+3.8	−.3	−1.0	−1.5	+.3
Nevada	+5.2	−2.0	−4.8	−.2	−.4	−.1	−.9	−.9	+2.0	+2.0	−1.9	−2.8	−.6
New England	−5.6	−3.7	−.5	+.5	−2.1	−2.6	+.7	+1.8	+.5	−.9	+5.9	+2.9	−.3
New Jersey	−6.7	−1.1	+2.6	+.6	−.6	−.2	+.8	+1.2	+.2	−1.2	+5.9	+1.8	+.3
New Mexico	−1.9	−1.8	−5.5	+3.8	+2.4	+1.9	+1.5	+1.8	+2.0	+.8	−3.4	+3.5	+.4
New York	−6.6	−1.7	+.6	+2.8	−2.1	−1.4	+.5	+1.3	+1.3	−1.3	+6.4	+2.5	+.2
North Carolina	−6.0	+.9	+6.7	+3.6	0	+.1	+.9	−.9	−2.2	−3.0	+5.5	+3.5	+.8
North Dakota	+2.2	−2.8	−6.3	−1.3	+1.7	−.4	+.3	+2.0	+6.8	+2.1	+2.8	−2.5	+.4
Ohio	−7.4	+1.3	+3.0	+4.8	−1.8	−.1	+.5	−.1	+1.0	−3.0	+5.1	+3.2	+.5
Oklahoma	−5.5	−3.5	−6.0	+5.5	+.8	+1.0	−.4	−1.8	+.1	−1.7	−1.5	+2.6	−.9
Oregon	+2.1	−2.2	−3.3	−4.4	−2.3	+2.0	−3.0	−2.1	+.1	−.8	−1.8	−5.2	−1.7
Pennsylvania	−8.1	0	+2.1	+2.1	−1.6	−.8	+.1	−.2	−.4	−2.4	+4.6	+1.4	−.3
South Carolina	−6.1	0	+2.6	+3.1	+.3	+.4	+.7	−1.4	−2.9	−4.2	+4.6	+3.1	0
South Dakota	+.1	−2.4	−3.4	+3.8	+1.1	−1.8	−.4	+1.1	+5.4	+.5	+.3	−1.9	+.2
Tennessee	−8.3	+1.1	+2.8	+4.2	−.7	+.8	+.9	−.8	−1.1	−2.7	+2.5	+2.6	+.1
Texas	−5.8	−2.2	−2.4	+4.4	+1.9	+2.2	+.5	+1.0	−1.0	−1.8	−3.0	+3.2	−.3
Utah	+1.5	−1.9	−6.8	−.2	+.8	−.3	−.8	0	+2.5	+1.1	−4.4	−2.4	−.8
Virginia	−6.5	+1.1	+3.1	+2.5	−.3	+.1	+.5	−.7	−1.5	−3.1	+4.1	+2.4	+.1
Washington	+1.0	−1.9	−2.7	−3.8	−1.8	+2.7	−3.4	−2.9	−1.2	−2.4	−2.1	−7.0	−2.5
West Virginia	−8.2	+2.5	+4.2	+4.8	−1.2	0	+.2	−.3	−1.0	−3.2	+4.4	+3.1	+.1
Wisconsin	−4.7	−.4	−1.3	+4.5	−.8	−.3	+1.2	+2.1	+3.8	−.3	+4.1	+1.1	+.8
Wyoming	+.7	−1.6	−3.7	+2.8	+2.7	+1.9	+.3	+2.2	+4.5	+1.3	−3.9	−3.6	+.4

TABLE 2—*Percentage of normal precipitation, 1948*

State	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Alabama	89	120	159	84	81	82	113	81	137	57	464	92	125
Arizona	13	120	83	12	9	76	78	90	57	131	2	151	77
Arkansas	78	172	120	69	102	120	115	120	27	76	149	95	115
California	44	49	110	270	138	145	125	50	69	79	53	102	88
Colorado	137	134	135	66	84	160	65	80	48	57	90	127	93
Florida	179	35	212	155	62	56	141	112	154	118	116	105	118
Georgia	97	105	178	116	116	67	134	85	113	101	358	122	127
Idaho	89	120	96	153	152	166	171	76	109	47	115	138	118
Illinois	74	112	157	57	91	98	169	52	78	74	130	128	100
Indiana	80	112	129	105	96	111	135	59	81	80	170	129	106
Iowa	44	173	154	102	59	75	118	67	50	82	155	126	89
Kansas	84	164	182	48	71	161	193	97	50	48	166	46	109
Kentucky	73	145	132	137	83	81	121	58	72	93	223	115	111
Louisiana	102	93	165	73	68	44	57	76	141	36	290	83	100
Maryland-Delaware	154	79	108	110	189	130	83	137	83	117	216	175	130
Michigan	86	100	158	118	82	105	86	61	53	80	147	97	93
Minnesota	55	188	90	126	39	94	104	105	57	46	139	121	89
Mississippi	94	154	151	86	69	76	88	103	178	45	369	84	123
Missouri	97	103	147	45	73	154	154	56	54	81	134	100	98
Montana	119	134	87	115	128	152	183	90	34	17	100	94	110
Nebraska	60	136	94	46	60	124	107	109	87	66	212	91	94
Nevada	22	63	80	82	68	198	13	33	102	79	46	103	72
New England	100	68	89	98	186	120	92	65	26	89	162	112	100
New Jersey	132	71	94	102	223	138	86	119	30	95	143	182	116
New Mexico	93	234	117	32	118	157	62	73	41	99	33	99	93
New York	90	86	114	123	131	111	92	89	37	89	144	141	103
North Carolina	111	119	128	78	120	76	82	96	111	86	33	129	114
North Dakota	85	210	57	150	61	89	166	88	20	96	179	138	102
Ohio	80	118	139	155	99	107	96	76	101	93	159	114	111
Oklahoma	68	195	141	48	100	168	136	132	14	32	86	60	97
Oregon	108	126	108	152	172	144	202	198	159	80	121	154	132
Pennsylvania	96	74	106	161	130	124	94	87	48	95	157	138	109
South Carolina	102	118	184	95	159	63	87	76	148	95	377	124	124
South Dakota	69	125	37	126	64	142	150	89	63	98	162	57	104
Tennessee	86	199	133	65	66	77	111	53	110	80	284	134	116
Texas	155	144	67	66	99	82	88	70	67	52	65	30	80
Utah	47	102	139	135	40	234	43	90	43	101	73	176	96
Virginia	102	86	116	131	145	99	84	140	105	115	239	172	125
Washington	90	145	83	139	262	147	256	267	149	73	121	111	128
West Virginia	86	116	110	167	107	109	118	95	106	84	114	152	115
Wisconsin	45	134	114	98	58	72	91	58	50	43	164	109	79
Wyoming	104	60	64	77	55	148	82	76	90	59	149	139	89

TABLE 3.—*Monthly and annual precipitation (inches), 1948*

State	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Alabama	4.52	6.31	9.58	3.79	3.18	3.58	6.23	3.77	4.58	1.47	15.30	4.53	66.84
Arizona	.16	1.56	.88	.08	.03	.26	1.64	2.11	.76	1.14	.02	1.95	10.59
Arkansas	3.32	6.08	5.72	3.46	5.15	4.91	4.11	4.25	.88	2.40	5.78	4.03	50.09
California	2.02	2.17	4.06	4.65	1.30	.48	.10	.05	.29	.86	1.08	3.75	20.81
Colorado	1.08	1.30	1.80	1.18	1.59	2.30	1.39	1.56	.64	.69	.71	1.12	15.36
Florida	4.96	1.07	6.94	4.54	2.44	3.80	10.44	7.85	10.37	4.92	2.56	2.90	62.79
Georgia	4.20	5.05	8.96	4.50	4.02	2.95	7.67	4.42	4.09	2.72	9.57	5.23	63.38
Idaho	1.88	2.10	1.70	2.20	2.57	2.38	1.13	.48	1.18	.71	2.41	2.86	21.60
Illinois	1.68	2.14	5.04	2.05	3.76	3.93	5.45	1.74	2.84	1.93	3.45	2.70	36.71
Indiana	2.36	2.70	4.84	3.85	3.93	4.37	4.48	1.95	2.68	2.19	5.24	3.50	42.09
Iowa	.45	1.90	2.64	2.66	2.34	3.42	4.14	2.54	2.02	1.89	2.68	1.39	28.07
Kansas	.59	1.62	2.73	1.28	2.69	6.57	6.09	3.04	1.42	.96	2.12	.42	29.53
Kentucky	3.18	5.01	6.26	5.49	3.32	3.35	5.04	2.13	2.09	2.45	7.71	4.34	50.37
Louisiana	5.06	4.22	8.12	3.40	3.20	2.07	3.44	3.87	5.77	1.15	12.08	4.42	56.90
Maryland-Delaware	5.05	2.27	3.84	3.86	6.92	5.11	3.60	6.13	2.79	3.56	5.68	5.49	54.30
Michigan	1.68	1.69	3.32	2.83	2.70	3.31	2.33	1.69	1.70	1.33	3.76	1.98	28.32
Minnesota	.40	1.45	1.09	2.69	1.26	3.92	3.37	3.47	1.64	.85	1.65	.92	22.71
Mississippi	4.86	7.57	8.85	4.22	3.00	3.19	4.44	4.26	5.51	1.14	13.80	4.41	65.25
Missouri	2.24	2.16	4.78	1.81	3.50	7.43	5.45	2.14	2.17	2.40	3.64	2.17	39.89
Montana	1.08	1.02	.84	1.30	2.69	3.99	2.52	.98	.47	.18	1.04	.89	17.00
Nebraska	.32	.94	1.05	1.11	2.03	4.65	3.26	2.91	1.81	.97	1.63	.62	21.30
Nevada	.25	.67	.78	.65	.58	1.05	.05	.16	.42	.54	.32	1.01	6.48
New England	3.42	2.06	3.20	3.27	6.49	4.25	3.47	2.44	.97	3.06	5.85	3.73	42.21
New Jersey	4.78	2.47	3.57	3.68	8.06	5.28	4.05	5.60	1.12	3.08	4.66	6.43	52.79
New Mexico	.55	1.64	.88	.28	1.44	1.95	1.49	1.80	.70	1.15	.21	.70	12.79
New York	2.59	2.27	3.51	3.74	4.66	4.10	3.64	3.28	1.28	2.93	4.42	4.17	40.59
North Carolina	4.19	4.75	5.38	2.78	4.78	3.52	4.89	5.27	4.51	2.83	9.02	4.89	56.81
North Dakota	.40	.90	.45	2.15	1.38	3.12	4.04	1.83	.31	.97	1.11	.66	17.41
Ohio	2.37	3.06	4.83	5.02	3.74	4.22	3.62	2.57	2.94	2.34	4.30	3.10	42.11
Oklahoma	.96	2.88	3.11	1.70	4.76	6.71	3.78	3.84	.45	.93	1.76	1.02	31.90
Oregon	4.06	3.99	2.98	3.04	3.07	1.93	.87	.87	1.89	1.60	4.52	6.08	34.90
Pennsylvania	3.02	2.07	3.71	5.55	5.24	5.19	4.04	3.62	1.62	3.08	4.56	4.25	45.95
South Carolina	3.66	4.88	7.36	3.10	5.52	2.96	5.10	4.33	6.04	2.77	9.00	4.46	59.18
South Dakota	.37	.70	.41	2.60	1.81	5.11	3.61	1.87	.97	1.17	1.05	.29	19.96
Tennessee	4.17	8.81	7.09	2.85	2.73	3.18	4.95	2.12	3.37	2.24	10.21	6.01	57.73
Texas	2.81	2.56	1.34	1.92	3.68	2.44	2.28	1.67	2.01	1.39	1.37	.69	24.16
Utah	.57	1.31	2.01	1.43	.48	1.66	.38	.96	.43	1.16	.68	1.87	12.94
Virginia	3.35	2.62	4.23	4.30	5.44	4.10	3.91	6.23	3.39	3.44	6.03	5.29	52.33
Washington	4.33	5.46	2.71	3.34	5.26	2.52	1.74	2.03	2.67	2.19	6.21	6.02	44.48
West Virginia	3.06	3.61	4.30	5.89	4.28	4.88	5.44	3.89	3.16	2.38	4.31	4.97	50.17
Wisconsin	.55	1.62	2.00	2.47	2.12	3.01	3.09	1.93	1.85	1.01	3.17	1.41	24.23
Wyoming	.81	.46	.72	1.24	1.13	2.62	1.08	.80	1.04	.65	1.10	.99	12.64

TORNADOES IN THE UNITED STATES DURING 1948

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[Weather Bureau, Washington, D. C.]

During 1948, 195 tornadoes were reported in the United States. This number is 53 more than the annual average, based on the period from 1916 through 1947. They occurred on 72 days and in 30 States. Ten crossed State boundaries. Georgia reported 23 tornadoes, the greatest number in any State during the year, but none of these were unusually destructive. The greatest amount of damage in Georgia by a single twister was reported on April 1, from Ware, Pierce, and Wayne Counties, where property losses amounted to $250,000 and two of the three deaths reported for the entire year occurred. Illinois had the second greatest number with 22 tornadoes, followed by Oklahoma with 19, Kansas with 17, and Texas with 16. Tornadoes were reported during each month, except December. March brought the greatest number, with 52 occurring during the month; April was second with 33, and May, the month in which the largest number usually occurs, was third with 29.

Although the number of tornadoes during the year was over a third greater than the average, the 141 deaths resulting were only about three-fifths of the average yearly total. The greatest loss of human life occurred in March, when 81 persons were killed. Of this number, 33 deaths were reported in Illinois, 20 in Indiana, 13 in Oklahoma, 6 in Ohio, 4 in Missouri, 3 in Alabama, and 2 in Kentucky, due to a series of tornadoes that swept across the country from Oklahoma to Pennsylvania during that month. Illinois also suffered the greatest loss of life for the year with a total of 37, followed by Indiana with 21, Oklahoma with 17, and Mississippi with 16.

The total estimated property damage of $53,977,650 for the year was nearly 4½ times the yearly average. Never before in 33 years of record has the financial loss been so great. This evidently is due partly to the increased valuation of property at this time. More than one-half of this damage occurred during the month of March. Oklahoma reported the greatest amount of damage for the year, with losses amounting to over $17,500,000. Nearly $17,000,000 of the Oklahoma damage occurred during March when over $10,000,000 in damage was reported at Will Rogers and Tinker Fields, Oklahoma City, Okla., on March 20 and within a week another $6,000,000 damage resulted from a second tornado at Tinker Field. The State suffering the next highest 1948 property loss was Kansas, with damage amounting to $11,047,500; Illinois reported losses of $7,408,000, Indiana $3,410,000, Texas $2,944,000, Ohio $2,450,000, and Nebraska, Missouri, and Iowa over $1,000,000 each.

Although the tornado which occurred at Will Rogers and Tinker Fields on March 20, and the one at Tinker Field 5 days later were the outstanding tornadoes of the year in regard to great property damage from single tornadoes, they were very unusual in that they caused no loss of life and only 9 slight injuries. The series of tornadoes which swept across the country on March 18 and 19 caused the greatest loss of life. On the 19th, the towns of Bunker Hill and Gillespie, Ill., were hard hit. Property damage was estimated at $3,000,000, with 249 homes completely destroyed, 425 homes damaged, 520 other buildings destroyed, and 800 damaged. The death toll was 24, and personal injuries 295.

Another severe tornado during March moved northeastward from Terre Haute to Redkey, Ind., on the 26th, destroying most of Coatsville and severely damaging Danville. It caused 20 deaths and $3,000,000 property loss.

On March 19, tornadoes struck at scattered points over Ohio. Property damage was estimated in millions of dollars. Six deaths occurred, and approximately 30 persons were injured. On the 25th of this month, a tornado took a toll of 13 lives, caused 44 injuries, and resulted in $350,000 property damage, as it swept over a path 102 miles long, across Hughes, McIntosh, Muskogee, and Sequoyah Counties, Okla., and then entered Arkansas where much of its violence was lost.

On June 21, another airport was struck by a tornado. Westport Field in southwestern Wichita, Kans., suffered $1,000,000 damage, mostly to aircraft. Twelve persons were injured, but no deaths were reported.

Several tornado clouds were observed during the year in areas where their occurrence is unusual. On April 11, a long, stringy funnel cloud was seen north of the airport at Cheyenne, Wyo. It was observed for about 10 minutes as it moved from the west-northwest, but it did not appear to reach the ground. Atmospheric conditions were not those usually existing during the occurrence of tornadoes; snow had been falling and the temperature was 33° with dewpoint 32°. Another tornado funnel was sighted and observed for about 20 minutes on May 20, at Billings, Mont. This cloud appeared to be about 35 miles south-southwest of the Billings Weather Bureau Station. The funnel extended and retracted quite rapidly. It reached the ground for a time early in its development, but no damage resulted. Other tornado clouds that remained aloft were observed at Kirtly, Wyo., on July 14 and at Winslow, Ariz., on October 19. At Winslow, a funnel descended from a dark cumulus cloud in a well formed cone and was soon joined by a second very ragged cone. Both cones disappeared without having reached the ground. A noise like rustling of cloth was heard during the life of the larger cone.

The tabulations for 1948 are shown in Table 1, which follows. They are derived from data on "Severe Local Storms" appearing in the MONTHLY WEATHER REVIEW and in the CLIMATOLOGICAL DATA publications for the different sections of the United States. The listing shows the approximate monthly and annual number of tornadoes, the number of resultant deaths and injuries, and the property damage caused in the several States and the country as a whole. The "Tracks of Tornadoes during 1948" are shown by chart.

TABLE 1.—*Tornadoes and probable tornadoes during 1948*

State*	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama:													
Number			4	1									5
Deaths			3	0									3
Injuries			47	3									50
Damage ($×1,000)			486.0	200.0									686.0
Arizona:													
Number										1			1
Deaths										0			0
Injuries										0			0
Damage ($×1,000)										0.0			.0
Arkansas:													
Number			1										1
Deaths			0										0
Injuries			0										0
Damage ($×1,000)			14.0										14.0
Colorado:													
Number				2									2
Deaths				0									0
Injuries				0									0
Damage ($×1,000)				(1)									(1)
Florida:													
Number	1		1			2	3		3	3			13
Deaths	0		0			0	0		2	0			2
Injuries	0		0			0	2		12	7			21
Damage ($×1,000)	25.0		.5			0.2	9.5		254.0	115.0			404.2
Georgia:													
Number			7	5	2		2		1		6		23
Deaths			0	3	0		0		0		0		3
Injuries			0	(1)	0		0		0		8		8
Damage ($×21,000)			127.5	320.0	11.2		9.5		75.0		150.9		694.1
Illinois													
Number			9	10		1	1	1					22
Deaths			33	4		0	0	0					37
Injuries			449	29		0	0	(1)					478
Damage ($×1,000)			3,902.0	1,726.0		10.0	210.0	1,500.0					7,408.0
Indiana:													
Number	1	1	1	5	2	1							11
Deaths	0	0	20	0	0	1							21
Injuries	0	0	(1)	0	0	20							20
Damage ($×1,000)	20.0	10.0	3,000.0	100.0	180.0	100.0							3,410.0
Iowa:													
Number				1	1	1	2						5
Deaths				5	0	0	0						5
Injuries				25	1	1	0						27
Damage ($×1,000)				250.0	1.5	450.0	323.0						1,024.5
Kansas:													
Number			1	2	4	7	2			1			17
Deaths			0	0	2	0	1			0			3
Injuries			(1)	1	5	13	(1)			0			19
Damage ($×1,000)			200.0	18.0	730.0	1,357.0	8,737.5			5.0			11,047.5
Kentucky:													
Number	1		1	2	1						2		7
Deaths	0		2	1	5						1		9
Injuries	0		(1)	(1)	(1)						1		1
Damage ($×1,000)	100.0		15.0	155.0	200.0						75.0		545.0
Louisiana:													
Number					1						2		3
Deaths					0						1		1
Injuries					0						31		31
Damage ($×1,000)					15.0						445.0		460.0
Maryland:													
Number			1										1
Deaths			0										0
Injuries			0										0
Damage ($×1,000)			45.0										45.0
Minnesota:													
Number				1									1
Deaths				0									0
Injuries				0									0
Damage ($×1,000)				50.0									50.0
Mississippi:													
Number	1	2	2								4		9
Deaths	1	5	0								10		16
Injuries	1	25	0								77		103
Damage ($×1,000)	50.0	115.0	15.0								810.0		990.0
Missouri:													
Number			7	1	2	1							11
Deaths			4	0	0	0							4
Injuries			40	1	2	1							44
Damage ($×1,000)			546.5	50.0	505.0	5.0							1,106.5
Montana:													
Number					2		2						4
Deaths					0		1						1
Injuries					0			(1)					0
Damage ($×1,000)					(1)		58.0						58.0
Nebraska:													
Number						4							4
Deaths						1							1
Injuries						0							0
Damage ($×1,000)						1,511.0							1,511.0
New Mexico:													
Number					1								1
Deaths					0								0
Injuries					0								0
Damage ($×1,000)					(1)								(1)
North Carolina:													
Number			1										1
Deaths			0										0
Injuries			4										4
Damage ($×1,000)			43.9										43.9

See footnotes at end of table.

TABLE 1.—*Tornadoes and probable tornadoes during 1948*—Continued

State*	January	February	March	April	May	June	July	August	September	October	November	December	Total
Ohio:													
Number	1		1		3	1							6
Deaths	0		6		0	0							6
Injuries	0		31		0	0							31
Damage ($X1,000)	100.0		‡ 2,000.0		350.0	(1)							‡ 2,450.0
Oklahoma:													
Number			11		4	4							19
Deaths			13		4	0							17
Injuries			59		204	0							263
Damage ($X1,000)			16,979.5		654.0	50.5							17,684.0
Pennsylvania:													
Number			1			1	1						3
Deaths			0			0	0						0
Injuries			3			0	0						3
Damage ($X1,000)			(1)			100.0	10.0						‡ 110.0
South Carolina:													
Number				2									2
Deaths				0									0
Injuries				(2)									(2)
Damage ($X1,000)				112.0									112.0
South Dakota:													
Number				3									3
Deaths				0									0
Injuries				0									0
Damage ($X1,000)				50.0									50.0
Tennessee:													
Number			2								1		3
Deaths			0								0		0
Injuries			2								0		2
Damage ($X1,000)			700.0								11.4		711.
Texas:													
Number		4	2	1	5		3	1					16
Deaths		3	0	0	3		0	0					6
Injuries		(1)	6	1	43		0	(1)					50
Damage ($X1,000)		175.0	160.0	30.0	2,551.0		3.0	25.0					2,944.0
West Virginia:													
Number					1	1							2
Deaths					4	0							4
Injuries					80	0							80
Damage ($X1,000)					250.0	(1)							‡ 250.0
Wisconsin:							4						4
Deaths							2						2
Injuries							13						13
Damage ($X1,000)							58.5						58.5
Wyoming:													
Number				1	1	1	2						5
Deaths				0	0	0	0						0
Injuries				0	0	0	0						0
Damage ($X1,000)				.0	10.0	100.0	(1)						‡ 110.0
Total:													
Number	5	7	†52	†33	†29	†24	22	2	†3	5	†13		195
Deaths	1	8	81	13	18	2	4	0	2	0	12		141
Injuries	1	25	‡ 641	‡ 60	335	35	15	(2)	12	7	117		‡ 1,248
Damage ($X1,000)	295.0	300.0	‡ 28,294.9	‡ 3,061.0	‡ 5,457.7	‡ 3,683.7	‡ 9,419.0	1,525.0	329.0	120.0	1,492.3		‡ 53,977.6

* None reported for States not listed.
† Corrected for boundary-crossing tornadoes.
‡ Datum unobtained.
§ Several.
‖ Not complete.
¶ Estimated.

NORTH ATLANTIC HURRICANES AND TROPICAL DISTURBANCES OF 1948

H. C. SUMNER
[Weather Bureau, Washington, D. C.]

The hurricane season of 1948 came to a close on November 10, when the last of 10 North Atlantic hurricanes and tropical disturbances dissipated into an area of squalls northeast of Cape Hatteras. Of the 10 storms detected during the year 5 reached the coast line of the United States and 5, affecting only islands, spent their energy at sea. The 6 tropical storms that developed winds of hurricane force (75 m. p. h. or more) were also equally divided in this respect.

Damage to property and crops in the United States, resulting from these storms, has been estimated at $18,400,000. Only three persons lost their lives. The small number of fatalities compared with the figures for property damage is unusual when compared with the ratio for previous seasons, but is in line with a trend that has been evident for many years. The trend stems from the fact that most property is immovable and, even with adequate warning, is difficult to protect. People, in contrast, can be evacuated and those following the advices of an alert warning service have little to fear when a hurricane approaches. A survey of the causes of hurricane casualties shows that personal carelessness is playing an ever-increasing role.

The following are individual reviews of all North Atlantic hurricanes and tropical disturbances that occurred during the 1948 season. A synopsis of the important features of these storms is given in Table 3; their tracks, numbered I to X, chronologically, are plotted on the chart following this article.

I. *Minor tropical disturbance of May 10–12.*—The first tropical storm of the season formed from an easterly wave south of the Bahamas, moved north-northwestward skirting the east Florida coast, and crossed the Georgia coast line near Savannah during the late afternoon of May 12. The highest wind, about 30 m. p. h., was reported from a ship east of the center.

II. *Tropical disturbance of May 22–28.*—Originating in a widespread low-pressure area southwest of Hispaniola, this storm began a northeastward movement and by 7 a. m. on May 22 was centered over southwestern Haiti accompanied by widespread heavy rains. These rains caused floods throughout much of Hispaniola. After leaving Haiti the storm moved north-northeastward and by May 25 was centered near latitude 30° N., longitude 69° W. where it remained practically stationary for 2 days.

The highest winds reported were about 50 m. p. h. observed from a reconnaissance plane which was flown through the storm on the 25th. During the afternoon of the 27th it began moving northward more rapidly and became an extra-tropical storm. Press reports from the Dominican Republic indicate that 80 persons were drowned in floods associated with this disturbance.

III. *Small tropical disturbance of July 7–11.*—This disturbance formed in an area of unsettled weather in the northern Gulf of Mexico during the afternoon of July 7, moved northeastward and passed inland over Pensacola, Fla., during the night of July 8. A highest wind of 35 m. p. h. was observed during a thunderstorm at the Pensacola station. This disturbance caused heavy rains over extreme northern Florida, southern Alabama, and southern Georgia. Little damage has been reported.

IV. *Hurricane of August 26–September 1.*—This storm was first reported during the night of August 25–26 by the S. S. *Virginia* and the S. S. *Petrakis Nomikos* when they encountered winds of Beaufort force 9 (47–54 m. p. h.) and other signs of a hurricane forming near latitude 20.5° N., longitude 60.5° W. From this area the hurricane moved on a west-northwesterly course to a point about 250 miles south of Cape Hatteras where the forward movement slowed and a turn to northeast began. This trajectory was some distance east of Hatteras and no dangerous winds occurred on land. Tides, however, were high on the North Carolina coast and justified evacuations and other precautions which were taken in the area.

A highest wind of 120 m. p. h. was estimated from reconnaissance aircraft which reconnoitered the storm on August 28 and 29. No loss of life or damage of consequence has been reported.

V. *Tropical storm of August 30–September 2.*—The first indication of the existence of this storm came from the S. S. *Benjamin H. Grierson*, which transmitted the following report during the afternoon of August 30:

> Position 2100 G. C. T., 14° N., 55° 45′ W. Vessel hove to; barometer 29.80; wind ESE 10; very high easterly seas; stratocumulus clouds.

From the above position this storm, of small diameter, advanced westward passing between St. Lucia and Martinique in the Lesser Antilles during the early evening of August 13. At 8:40 a. m. on September 1, a reconnaissance plane located the center at latitude 14.12° N., longitude 63.15° W. with lowest pressure 1007 millibars (29.74 inches) and highest wind 28 knots. Subsequent reconnaissance failed to locate the center. This storm was minor in character, and it apparently weakened from the time of the report from the S. S. *Grierson* until it dissipated near latitude 15° N., longitude 66° W. No reports of property destruction or loss of life from the storm have been received. Resulting heavy rains, especially on the island of Puerto Rico, were very beneficial to crops and water supply and more than offset minor damage caused by floods.

VI. *Gulf hurricane of September 3–6.*—This hurricane developed in an area of unsettled weather that had prevailed for several days in the southwestern Gulf of Mexico. Aircraft reconnaissance reported development of a complete circulation with an ill-defined center on the morning of September 3. From a position near 25° N., 92.5° W. the storm moved north-northeastward and crossed the Louisiana coast line a short distance west of Grand Isle. The lowest pressure at Grand Isle was 990.2 millibars (29.24 inches) at 3 a. m. and the highest winds 63 m. p. h. from the south-southeast at 2 a. m. on September 4. Passing over a sparsely settled coastal area, the center reached New Orleans early on the 4th of September, with a highest wind velocity of 78 m. p. h. from the north-northeast recorded at Moisant Airport at 3:50 a. m. At Huey Long Bridge a low pressure of 989.2 millibars (29.21 inches) was recorded from 6:15 to 6:20 a. m. with winds of 64 m. p. h. Moving inland the storm reached Hattiesburg, Miss., at 2 p. m., with winds reduced to 40 m. p. h. Thereafter it decreased steadily in intensity, but the circulation was maintained as it passed near Memphis, Tenn., and Cairo, Ill.

Tides at New Orleans rose from 2.0 feet on September 3 to 4.7 feet on September 4. The highest tide along the Mississippi coast was about 6 feet. At Mobile, Ala., it reached 5.3 feet and at Pensacola, Fla., 3.4 feet.

In New Orleans Parish damage was confined to small boats, signs, trees, and power and communication lines, with damage estimated at $100,000. The heaviest

damage occurred near Grande Isle when immovable oil-drilling rigs and equipment in the Gulf of Mexico were demolished by heavy seas.

No loss of life or serious injuries directly attributable to the hurricane were reported. Total property and crop damage was approximately $900,000 divided among the four States affected as follows: Louisiana $660,000; Mississippi $140,000; Alabama $88,000, and Florida $12,000.

VII. *Hurricane of September 3–15.*—This hurricane, which had an unusually long history, was first reported on September 3 when it moved off the African mainland near Dakar. It followed a westerly course during the next several days until on September 9, it was detected by aircraft reconnaissance near latitude 17.5° N., longitude 47° W. Thereafter it moved on a broad curving path over the Atlantic, passing a short distance west of Bermuda on the 13th. Winds at Bermuda exceeded 100 m. p. h., and damage was reported as heavy. After passing Bermuda the hurricane continued its broad curve over the North Atlantic, passing south of Cape Race, Newfoundland, on the 15th. It is notable that for the second year in a row a hurricane has been traced to a point of origin over West Africa. During its 12-day history this hurricane traveled approximately 3,500 miles, or roughly the distance from New York to London.

VIII. *Florida hurricane of September 18–25.*—This most destructive hurricane of 1948 developed in the western Caribbean between Jamaica and Grand Cayman Island on September 18. It formed from an easterly wave that had been under observation since it passed through the Lesser Antilles on the 14th. After a center developed on the 18th, it moved very slowly, turned to a northerly direction, and passed over western Cuba with the center moving between Havana and Matanzas on the 20th. At this time it was a fully developed hurricane, with winds well over 100 m. p. h., and reports indicate that the city of Matanzas suffered extensive damage. Some damage occurred at Havana where the wind reached 90 m. p. h. from the north. Press reports indicate that 10 persons were killed by the storm in Cuba and that property damage reached "several million dollars."

Leaving Cuba the hurricane crossed the Florida Straits and by noon of the 21st the center was very close to Key West and due east of the station. The lowest barometric pressure recorded on the Keys was 963.4 millibars (28.45 inches) observed at the Boca Chica Airport, 8 miles east-northeast of the Key West city office. The wind speed at this same station reached 122 m. p. h. before the anemometer was blown away. This was the highest reported in this hurricane but undoubtedly higher winds were experienced. Boca Chica was in the western portion of the calm center for a period of 15 minutes beginning at 11 a. m., September 21.

A tabular listing of lowest pressure, maximum wind, total rainfall, and miscellaneous meteorological data for selected stations in Florida is contained in TABLE I. Stations are arranged in a time sequence corresponding, as nearly as possible, to the order in which they were affected by this hurricane.

After leaving the Keys the center moved onto the mainland a short distance east of Everglades City, crossed Lake Okeechobee between Clewiston and Belle Glade and passed into the Atlantic at Jenson Beach near Stuart. By the time the Lake Okeechobee section was reached, wind velocities had been reduced to about 90 to 95 m. p. h., while on the Atlantic coast where the center passed to sea readings were slightly below hurricane force for sustained velocities, but with gusts above hurricane force. There was some intensification of the hurricane after it moved northeastward between Hatteras and Bermuda, finally reaching a point south of Newfoundland, on September 25.

Table 1.—Meteorological data for hurricane Sept. 18–25, 1948

Station	Date	Pressure[1]		Wind data						Rainfall	Miscellaneous
		Low	Time	5-min. max.	Time	1-min. max.	Time	Gusts	Hours of gales[2]		
Dry Tortugas	21	29.17	11:00 a. m.	76	10:55 a. m.	78	10:58 a. m.		48		
Key West, WBAS	21	28.45	11:15 a. m.			[3] 122 NNW	12:50 p. m.	[3] 150	42		Lull ½ hour. Did not clear.
Key West, WBO	21	28.73	11:30 a. m.	73 NW	12:07 p. m.	75 NW	12:08 p. m.		16	6.33	
Sombrero Key	21	29.12	1:00 p. m.	120 SE	1:00 p. m.	120 SE	1:00 p. m.				
Tavernier	21	29.32		[3] 80 SE				[3] 90		6.02	Wind lulled to 12–18 m. p. h. for 10–15 minutes. 5.0-ft. tide.
Carysfort Reef	21	29.24	2:15 p. m.	74 ENE	7:20 p. m.	80 ENE	7:23 p. m.		44		
Everglades City	21					120 NNW					
Naples	22	28.99	1:15 a. m.	80 W	5:30 a. m.	86 W	5:30 a. m.	87	15	4.90	
Fort Myers	22	29.05	3:30 a. m.			50 NNW	5:30 a. m.	88	15	8.09	
Miami, WBO	22	29.11	4:42 a. m.	62 SE	12:35 a. m.	76 SE	(21) 2:43 p. m.	32			
						76 S	(22) 12:35 a. m.				
Miami, WBAS	22	29.09	5:15 a. m.	70 SSE	12:58 a. m.	75 SSE	12:56 a. m.	90	31	11.00	
Moorehaven	22	28.62	6:00 a. m.	60 NE	6:00 a. m.	79 NE	6:00 a. m.		29		Partial lull; 20 m. p. h., 9 a. m.
Clewiston	22	28.47	6:30 a. m.	84 ENE	5:04 a. m.	96 ENE	5:04 a. m.		19	10.07	No lull. Flooded to depth of 2 or 3 ft.
Lake Placid	22	29.15	8:45 a. m.	[3] 55 NW	10:30 a. m.	[3] 65 NW	11:00 a. m.	81		8.43	Wind shifted from east through north to northwest.
Belle Glade	22	28.54	8:00 a. m.	60 W	2:00 p. m.	60 W	2:00 p. m.			8.47	Lull about ½ hour 8–8:30 a. m.
Canal Point	22	28.50	8:30 a. m.	[3] 100 W	2:30 p. m.					10.00	Lull 10 minutes, 8:30 a. m., and another lull at 12 noon to 12:45 p. m.
Hillsboro Light	22	29.05	8:30 a. m.	83 NE	2:05 a. m.	87 NE	2:06 a. m.		39		
Okeechobee City	22	28.86	10:15 a. m.	44 NW	2:30 p. m.	76	2:30 p. m.		4	4.89	Lull 2–2:30 p. m.; shift from southeast to southwest.
Pahokee	22			[3] 70–80 NNW	3:00 p. m.	[3] 90–100	2–4 p. m.				Lull 8 a. m., ½ hour; lull again 11 a. m.; sky clear both lulls.
West Palm Beach	22	28.85	8:45 a. m.			58 W	3:42 p. m.	84	23	9.04	
Stuart	22	28.51	12:30 p. m.	60 NW						6.36	Lull 2–3:30 p. m.; sky cleared; sun out.
Fort Pierce	22	28.82	12:30 p. m.	58 ESE	5:00 a. m.	58 ESE	5:00 a. m.		6		
Melbourne	22	29.02	2:27 p. m.	48 NNE	10:29 a. m.	52 NE		74	8	8.53	
Cocoa Beach	22			[3] 50 NNE	10:30 a. m.			[3] 60			Indian River highest in many years.
Vero Beach, WBAS	22	28.83	2:45 p. m.	55 NW	5:30 p. m.	[3] 80	5:06–5:30 p. m.	70–80		5.25	Wind lulled to 10–20 m. p. h., 2:30 p. m.
New Smyrna	22	29.36	2:00 p. m.			52 NE			6	2.25	
Drane Field (Lakeland)	22			40 N	10:35 a. m.	45 N	10:35 a. m.				
Lakeland, WBO	22	29.33	2:30 p. m.	24 NE	1:25 p. m.	29 NW	12:25 p. m.				
Orlando	22	29.27	1:45 p. m.	35 N	1:45 p. m.					5.71	Lightning to west 2–3 a. m., 22d.
Titusville	22					[3] 40 NE					
Daytona Beach	22	29.34	4:28 p. m.	31 NNW	2:10 p. m.			52		2.09	Thunder heard a few times.
St. Augustine	22			48 NE	5:45 p. m.	63	5:45 p. m.		5		

[1] Pressure reduced to sea level.
[2] Over 38 m. p. h.
[3] Estimated.

TABLE 2.—*Meteorological data for hurricane of October 4–8, 1948*

Station	Date	Pressure [1]		Wind data						Rainfall	Miscellaneous
		Low	Time	5-min. max.	Time	1-min. max.	Time	Gusts	Hours of gales [2]		
Key West WBO	5	29.25	12 noon	45 N	12:12 p. m.	56 NE	11:35 a. m.			4.56	Severe lightning and thunder 11:19-11:24 a. m.
Boca Chica WBAS	5	29.16	12:25 p. m.			[2] 85+ N.		[2] 120 N		3.73	
Sombrero Key	5	28.80	1:15 p. m.	[2] 100 S.	1:00 p. m.	[2] 100 S.	1:00 p. m.				
Alligator Light	5	29.38	3:00 p. m.			[2] 96 SE.	1:00 p. m.	[2] 110			No lull.
Tavernier	5	29.38	5:00 p. m.			60-70 SSW.	5:00 p. m.			6.40	Do.
Homestead Experiment Station.	5	28.95	6:00 p. m.	[2] 90 NW.	7:30 p. m.					8.81	Lull 5:45–6:05 p. m.—wind shifted south-southeast to west-northwest.
Fowey Rock Light	5	29.16	8:00 p. m.								
Miami WBAS	5	28.92	7:06 p. m.			68 ESE.	6:25 p. m.	90 NW	4	2.95	Lull 7–7:35 p. m.—wind dropped to 3 m. p. h.
Miami WBO	5	28.96	7:15 p. m.	79 NW.	9:05 p. m.	86 NW.	9:05 p. m.	90 NW	6	6.02	Lull 7–7:45 p. m.—wind dropped to 19 m. p. h.—no flat calm.
Hillsboro Light	5	29.26						[2] 90-100			Wind register defective.
Everglades City	5	29.56	4:00 p. m.	20 N.	4:30 p. m.			35 N		2.50	
Fort Myers	5	29.64	5:26 p. m.			19 N.	7:07 p. m.				
Okeechobee	5	29.62	9:00 p. m.	30 NNW.	10–11 p. m.						
West Palm Beach WBAS	5	29.45	10:30 p. m.			55 N.	11:05 p. m.	62	2½	7.48	No lull.
Belle Glade Experiment Sta.	5	29.69	11:15 p. m.	24 E.	9:50 p. m.	30 E.	9:50 p. m.			1.16	
Vero Beach WBAS	5	29.64	1:30 a. m. 6th	30 NE.	10:30 p. m.	39 NE.	10:30 p. m.			.60	

[1] Pressure reduced to sea level. [2] Winds over 38 miles per hour. [3] Estimated.

An unusual feature of this hurricane was the number of calms and lulls reported from widely separated points. Several stations in the Lake Okeechobee area reported two distinct "eyes" with blue sky and calms in each, spaced several hours apart. Such widely separated places as Tavernier, Boca Chica, Okeechobee City, and Stuart reported lulls. These stations lie 40 to 80 miles apart on an east-west axis. These reports appear to be substantiated by actual records and leave little doubt that the central vortex was distorted, or even divided into several partially or fully developed centers.

Mr. Grady Norton, meteorologist in charge of the Miami Office has written a descriptive account of this phase of the hurricane which is quoted below:

> When the hurricane was in Cuba, a news writer called it "a blind behemoth," but we believe a more descriptive character comes from mythology in Cyclops, the one-eyed giant. To carry the simile further, Cyclops must have encountered Ulysses in Cuba, because something happened to his eye! When he came out into the Florida Straits, the "eye" was distorted and elongated, and to some extent broken up, and it reminded us of Argus, otherwise known as Panoptes, for when it came over Florida on the 21st and 22d there was an eye for everybody! There were so many eyes reported at so many widely separated places, and the movement was so slow (about 8 to 10 m. p. h.), we were reminded of an oxcart. So "Oxcart Panoptes" made his leisurely way up through the Florida Everglades ogling every community in the southeastern part of the State!

A summary of casualties and estimated damage follows:

Casualty and damage summary for Florida

Deaths	3
Injuries requiring hospital care	45
Homes destroyed	39
Homes damaged severely	1,161
Buildings other than homes destroyed	40
Buildings other than homes damaged	237
People sheltered in 213 Red Cross shelters	38,323
Damage estimates	
Property damage (all kinds)	$5,000,000
Crop damage (all kinds)	6,500,000
Power and communications	300,000
Highways, streets, and bridges	200,000
Total for Florida	12,000,000

Heavy rainfall, which amounted to a total of 10 to 11 inches in places and averaged about 8 inches for the entire Everglades-Okeechobee area, caused considerable flooding throughout the area. Clewiston was flooded to a depth of 2 or 3 feet, La Belle was under water for several days, while Everglades City got its usual bath of salt water from the Gulf. Flooding of pastures caused loss of some cattle, and required the extensive evacuation of herds to higher ground. In the lower east coast and Indian River areas there was considerable loss to citrus and other tropical fruits as well as to fall truck crops.

IX. *Hurricane of October 4–8.*—Forming in the western Caribbean Sea this hurricane was first reported as an organized storm at 10:45 a. m. on October 4, near latitude 19.6° N., longitude 85° W. It increased rapidly in intensity during the night and moved northeastward across Cuba with the center passing a short distance west of Havana at 6 a. m. of the 5th. The highest wind at Havana was 132 m. p. h. Considerable damage resulted in the city and crop losses were heavy in Havana and Pinar Del Rio provinces. There were 11 deaths and 300 injuries in Cuba, with property damage estimated at $6,000,000.

By noon of the 5th the center was over the Keys. At Bahia Honda Bridge and Marathon a lull of about 45 minutes occurred. Winds were well over 100 m. p. h. in this area of the Keys. By 7:25 p. m. the calm center was over Miami. The Miami Airport Station was apparently very near the center of the storm, with lowest pressure 979.3 millibars (28.92 inches) with the wind dropping to 3 m. p. h. At the Airport the lull lasted from 7 p. m. to 7:35 p. m. and at the City Office 7 miles to the east, from 7 p. m. to 7:45 p. m. However, at the City Office the wind did not drop below 19 m. p. h. and the lowest pressure was 980.7 millibars (28.96 inches).

Because of a better exposure the highest wind, 86 m. p. h., from the northwest with several gusts of 15 seconds above 90 m. p. h., occurred at the City Office. A tabular listing of meteorological data associated with this hurricane is contained in TABLE 2.

Over Florida the hurricane moved at a fairly rapid rate of about 18 to 20 m. p. h. until it passed into the Atlantic in the Fort Lauderdale-Pompano area about 9:30 p. m. of the 5th. Since the lull lasted 35 to 45 minutes at Miami, the center of the storm was about 15 miles in diameter. The sky remained overcast with low stratus clouds during passage of the center.

Three tornadoes were reported along the advancing edge of this hurricane; one at Opa Locka destroyed several houses, another at Fort Lauderdale caused minor damage, and a third at Pompano destroyed about 25 houses, many of which were occupied at the time. A characteristic tornado dip and recovery in pressure recorded on barograph traces from the Keys to Hillsboro Lighthouse seems to indicate that a single tornado may have dipped to earth at several places as it progressed northeastward in advance of the hurricane vortex.

An unusual occurrence during this storm was reported from a small summer colony situated on Cudjoe Key. A home was unroofed during the September hurricane and

the roof blown or floated northwestward for a distance of about 200 yards. Two weeks later, during the October hurricane, the same roof was floated back across the highway and came to rest in almost the exact location in which it had been originally constructed.

No deaths or critical injuries have been reported from Florida as a result of this hurricane. It is extremely unusual for a hurricane of such intensity to pass over heavily populated areas without loss of life. A summary of casualties and estimated damage follows:

Casualty and damage summary for Florida

Deaths	None
Injured	42
Homes destroyed	36
Homes damaged severely	638
Buildings other than homes destroyed	45
Buildings other than homes damaged	50
Persons sheltered in 143 Red Cross shelters	21,663

Damage estimates

Property damage (includes flooding)	$3,500,000
Crop damage	1,500,000
Power and communications	400,000
Highways, streets, etc	100,000
Total	5,500,000

The Miami office issued 26 advisory and warning bulletins in connection with this hurricane.

After leaving Florida there was an acceleration in the forward movement of the hurricane as it passed north of Grand Bahama Island, with West End reporting winds of near hurricane force. Continuing a rapid northeastward and later eastward movement, the center passed almost directly over Bermuda during the late afternoon of the 7th, where winds in excess of 100 m. p. h. were experienced. The storm later dissipated in mid-Atlantic in the vicinity of latitude 32° N., longitude 48° W.

X. *Tropical disturbance of November 8–10.*—A tropical disturbance was detected on the afternoon of November 8 over the Atlantic, in the vicinity of latitude 26° N., longitude 67.5° W. At that time it had a small area of winds of about hurricane force. Estimates made from reconnaissance planes indicated highest winds of about 60 to 70 knots which were maintained during the next 2 days as the storm moved on a curving course to the northwest and north. By late afternoon of the 10th the organized center began to disintegrate and the wind rapidly lost force, so that by the time it passed east of Hatteras it had dissipated into an area of squalls to the east of the original center. No damage has been reported in connection with this storm.

Table 3.—*North Atlantic hurricanes and tropical disturbances of 1948*

[Number of storm in table corresponds to number of track on following chart]

Storm	Date	Area where first reported	Coast lines crossed	Highest wind speed reported	Lowest pressure reported [1]	Place of dissipation reported	Intensity	Remarks
I	May 10–12	South of the Bahamas.	Georgia	30 m. p. h. from a ship east of the storm center.	No data	Central North Carolina.	Minor disturbance.	No damage reported.
	May 22–28	Southwest of Hispaniola.	Haiti	50 m. p. h. estimated from reconnaissance plane near 30° N. latitude; 60° W. longitude.	do	Atlantic Ocean northwest of Bermuda.	Not of hurricane intensity.	Press reports indicate 80 persons were drowned in the Dominican Republic by floods which resulted from this disturbance.
III	July 7–11	North-central Gulf of Mexico.	Western Florida.	35 m. p. h. at Pensacola, Fla.	do	Western Tennessee.	Small tropical disturbance.	The disturbance caused heavy rains over extreme northern Florida, southern Alabama, and southern Georgia. No damage reported.
IV	Aug. 26–Sept. 1.	Northeast of Leeward Islands.	None	120 m. p. h. estimated from reconnaissance aircraft along the track between longitudes 29° and 30° N.	do	Atlantic Ocean south of Newfoundland.	Hurricane	No dangerous winds occurred on land.
V	Aug. 30–Sept. 2.	Near latitude 14° N., longitude 53° W.	None	Beaufort force 10 (55–63 m. p. h.) reported by the S. S. *Benjamin H. Grierson* at latitude 14° N., longitude 55° 27′ W.	1009.1 millibars (29.80 inches) reported by the S. S. *Benjamin H. Grierson.*	Eastern Caribbean Sea.	Not of hurricane intensity.	Heavy rains on the island of Puerto Rico were very beneficial to crops and water supply, and more than offset minor damage from floods.
VI	Sept. 3–6	Central Gulf of Mexico.	Louisiana	78 m. p. h. from the north-northeast at Moisant Airport, New Orleans, La.	989.2 millibars (29.21 inches) at New Orleans City Office.	Northern Indiana	Hurricane	Damage in Louisiana, Mississippi, Alabama, and extreme northwest Florida estimated at $900,000. No loss of life has been reported.
VII	Sept. 3–15	Western Africa	None	140 m. p. h. estimated from reconnaissance planes along the track from 25° to 35° N. latitude.	No data	Atlantic Ocean east of Newfoundland.	do	Reports indicate heavy damage in Bermuda.
VIII	Sept. 18–25	Between Jamaica and Grand Cayman Island.	Cuba and Florida.	122 m. p. h. at Boca Chica Airport near Key West.[2]	963.4 millibars (28.45 inches) at Boca Chica Airport.	Atlantic Ocean southeast of Newfoundland.	Severe hurricane.	Total damage in Florida estimated at $12,000,000, of which $5,500,000 was property damage and $6,500,000 damage to crops. 10 persons were reported killed in Cuba and 3 lost their lives in Florida.
IX	Oct. 4–8	Northwestern Caribbean Sea near latitude 19° 30′ N., longitude 85° W.	Cuba, Florida, and Bermuda.	132 m. p. h. at Havana, Cuba.	979.3 millibars (29.92 inches) at Miami.	Mid-Atlantic Ocean	do	Damage in Florida estimated at $5,500,000.
X	Nov. 8–10	Near latitude 26° N., longitude 67.5° W.	None	70 to 80 m. p. h. estimated from reconnaissance aircraft.	No data	Over the ocean northeast of the North Carolina Capes.	About hurricane intensity.	No strong winds occurred on land.

[1] Pressure reduced to sea level. [2] Anemometer failed with wind registering 122 m. p. h.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR DECEMBER 1948

AEROLOGICAL OBSERVATIONS

[For description of change in Table 1 and charts, see REVIEW, January 1946, p. 6. For change in computation of relative humidity data after October 1, 1948, see REVIEW October 1948, p. 225]

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during December 1948*

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Albany, N. Y. (1,007.2 mb.)				Albuquerque, N. Mex. (837.6 mb.)				Atlanta, Ga. (984.5 mb.)				Big Spring, Tex. (927.7 mb.)				Bismarck, N. Dak. (954.1 mb.)				Boise, Idaho (916.5 mb.)				Brownsville, Tex. (1,016.5 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	86	−1.6	80	31	1,620	4.2	43	31	300	8.0	77	30	774	8.9	45	31	505	−12.3	77	31	868	−3.8	80	31	6	18.4	83
1,000	31	142	(*)	----	31	149	(*)	----	31	171	(*)	----	30	141	(*)	----	31	140	(*)	----	31	171	(*)	----	31	146	19.6	79
950	31	557	−2.1	68	31	585	(*)	----	31	599	8.8	71	30	577	(*)	----	31	542	(*)	----	31	585	(*)	----	31	590	18.3	69
900	31	980	−3.8	66	31	1,033	(*)	----	31	1,043	8.6	67	30	1,025	11.4	36	31	955	−7.9	67	31	1,012	−2.0	69	31	1,050	16.8	58
850	31	1,430	−5.4	62	31	1,499	(*)	----	31	1,516	7.7	57	30	1,504	11.6	31	31	1,399	−7.9	60	31	1,465	−4.0	66	31	1,537	16.1	40
800	31	1,904	−7.1	58	31	1,993	4.0	44	31	2,014	6.4	51	30	2,008	9.6	31	31	1,870	−8.7	57	31	1,941	−6.2	65	31	2,051	14.2	36
750	31	2,415	−8.6	50	31	2,520	1.6	46	31	2,548	4.4	41	30	2,548	6.7	33	31	2,373	−10.7	51	31	2,449	−8.7	64	31	2,596	11.7	35
700	31	2,938	−10.5	43	31	3,068	−1.5	50	31	3,101	1.8	33	30	3,103	3.4	33	31	2,896	−13.2	45	31	2,976	−11.3	61	31	3,166	8.2	38
650	30	3,511	−13.3	43	31	3,658	−5.0	49	31	3,697	−1.1	----	30	3,703	−.4	33	31	3,464	−16.5	44	31	3,546	−14.5	59	31	3,774	4.4	34
600	30	4,111	−16.8	----	31	4,279	−8.6	39	31	4,329	−4.7	----	29	4,335	−4.7	34	31	4,054	−20.3	41	31	4,143	−18.4	56	31	4,420	.4	32
550	30	4,763	−20.4	----	31	4,952	−12.0	34	31	5,009	−8.9	----	29	5,016	−8.8	37	31	4,697	−24.3	----	31	4,788	−22.5	----	31	5,112	−4.0	30
500	30	5,460	−24.6	----	31	5,671	−16.8	36	31	5,740	−13.7	----	29	5,746	−13.9	----	31	5,382	−28.6	----	31	5,481	−26.9	----	31	5,858	−9.1	31
450	30	6,228	−29.0	----	30	6,459	−21.8	----	31	6,541	−18.8	----	29	6,544	−18.4	----	29	6,140	−33.1	----	30	6,234	−32.2	----	31	6,670	−14.7	33
400	30	7,053	−34.2	----	30	7,310	−27.8	----	31	7,401	−24.9	----	29	7,411	−24.4	----	29	6,954	−38.7	----	29	7,059	−37.7	----	31	7,546	−20.9	----
350	30	7,975	−39.9	----	29	8,254	−34.6	----	31	8,358	−32.0	----	29	8,369	−31.6	----	29	7,859	−45.2	----	28	7,966	−44.0	----	30	8,519	−28.3	----
300	30	9,013	−46.6	----	29	9,313	−42.3	----	31	9,428	−40.3	----	29	9,441	−40.1	----	29	8,872	−51.8	----	28	8,985	−50.4	----	30	9,604	−36.9	----
250	30	10,204	−53.1	----	29	10,523	−50.5	----	29	10,640	−49.9	----	27	10,656	−49.6	----	23	10,051	−55.2	----	28	10,158	−55.4	----	30	10,839	−46.7	----
200	30	11,626	−56.3	----	28	11,951	−57.7	----	28	12,065	−58.9	----	21	12,094	−57.1	----	19	11,483	−55.2	----	26	11,568	−55.6	----	23	12,282	−57.1	----
175	29	12,479	−56.5	----	25	12,796	−59.3	----	28	12,896	−62.0	----	20	12,930	−59.4	----	18	12,329	−54.0	----	20	12,408	−54.6	----	22	13,113	−61.2	----
150	27	13,454	−56.0	----	20	13,763	−58.9	----	28	13,844	−63.9	----	16	13,884	−60.9	----	11	13,345	−53.1	----	16	13,397	−54.6	----	21	14,065	−65.1	----
125	21	14,595	−57.8	----	12	14,909	−61.7	----	26	14,952	−66.1	----	10	15,035	−63.6	----	8	14,534	−52.8	----	11	14,584	−55.4	----	15	15,163	−69.4	----
100	15	15,997	−58.3	----	5	16,296	−63.2	----	22	16,299	−69.7	----									6	16,043	−56.4	----	8	16,465	−73.2	----
80	6	17,503	−62.2	----					16	17,622	−70.6	----																
60									6	19,348	−68.0	----																

Standard pressure surface (mb.)	Buffalo, N. Y. (990.4 mb.)				Camaguey, Cuba (1,003.7 mb.)				Caribou, Maine (991.7 mb.)				Charleston, S. C. (1,018.3 mb.)				Ciudad Victoria, Mexico (976.3 mb.)				Columbia, Mo. (988.8 mb.)				Dodge City, Kans. (923.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	221	0.2	75	31	122	20.7	95	31	191	−7.4	84	31	13	10.5	88	30	335	21.1	57	31	239	2.0	72	31	792	−0.3	71
1,000	31	143	(*)	----	31	154	21.2	93	31	125	(*)	----	31	165	12.9	79	30	126	(*)	----	31	146	----	----	31	149	(*)	----
950	31	557	−.5	69	31	605	20.6	85	31	527	−6.8	76	31	599	12.0	71	30	573	20.8	55	31	566	2.7	62	31	567	(*)	----
900	31	983	−3.4	70	31	1,068	18.4	72	31	946	−8.3	71	31	1,048	10.2	68	30	1,037	18.2	56	31	999	2.0	54	31	1,001	2.4	57
850	31	1,434	−5.0	64	31	1,557	15.4	68	31	1,389	−9.8	63	31	1,522	8.7	57	30	1,525	16.1	52	31	1,460	1.3	49	31	1,464	3.1	43
800	31	1,908	−6.5	56	31	2,069	12.6	60	31	1,855	−11.3	59	31	2,022	7.0	46	30	2,038	14.5	46	31	1,946	−.6	47	31	1,954	1.8	37
750	31	2,420	−8.4	51	31	2,613	10.3	44	31	2,354	−12.6	57	31	2,559	5.3	41	30	2,585	12.0	47	31	2,466	−2.8	47	31	2,478	−.2	35
700	31	2,944	−10.2	46	31	3,180	7.4	33	31	2,874	−14.5	53	31	3,112	2.9	34	30	3,157	8.4	47	31	3,003	−5.5	48	31	3,021	−3.0	34
650	31	3,522	−12.8	44	31	3,792	4.7	23	31	3,438	−17.4	51	31	3,713	−.4	35	30	3,767	4.6	42	31	3,589	−8.6	46	31	3,608	−6.5	35
600	31	4,120	−16.0	39	30	4,435	1.0	----	31	4,028	−20.8	----	30	4,345	−4.3	34	29	4,414	.8	----	31	4,198	−11.7	40	31	4,225	−10.4	34
550	29	4,769	−20.1	37	29	5,133	−3.1	----	31	4,667	−24.6	----	30	5,029	−8.4	33	29	5,110	−3.6	----	30	4,864	−15.3	40	31	4,892	−14.6	35
500	29	5,466	−24.2	----	29	5,877	−8.0	----	31	5,354	−29.2	----	29	5,762	−13.1	33	28	5,854	−8.7	----	30	5,573	−19.9	42	31	5,605	−19.4	33
450	29	6,233	−28.9	----	28	6,698	−13.9	----	31	6,102	−34.4	----	29	6,561	−18.8	37	28	6,673	−14.1	----	30	6,351	−25.1	----	31	6,383	−25.0	----
400	25	7,076	−34.1	----	28	7,570	−20.7	----	31	6,914	−39.8	----	29	7,425	−24.7	----	28	7,550	−20.5	----	30	7,193	−31.1	----	31	7,225	−31.1	----
350	22	7,998	−40.1	----	25	8,543	−28.6	----	30	7,810	−45.4	----	28	8,383	−31.6	----	28	8,523	−28.1	----	29	8,136	−37.3	----	31	8,158	−37.6	----
300	18	9,044	−46.8	----	25	9,626	−37.6	----	30	8,827	−49.6	----	28	9,455	−39.7	----	28	9,611	−36.6	----	27	9,191	−44.0	----	31	9,205	−44.5	----
250	13	10,219	−52.3	----	22	10,858	−47.5	----	30	10,012	−52.2	----	25	10,685	−49.1	----	28	10,849	−46.3	----	23	10,415	−51.3	----	30	10,404	−51.8	----
200	12	11,665	−55.3	----	22	12,296	−58.1	----	26	11,472	−53.3	----	23	12,123	−58.2	----	27	12,298	−57.1	----	16	11,859	−57.6	----	28	11,823	−57.3	----
175	7	12,512	−54.6	----	21	13,129	−63.0	----	24	12,330	−53.6	----	19	12,951	−61.1	----	26	13,133	−62.0	----	14	12,701	−58.5	----	24	12,650	−57.4	----
150	5	13,461	−54.3	----	20	14,063	−68.3	----	20	13,342	−53.8	----	17	13,901	−62.2	----	26	14,076	−66.4	----	9	13,691	−60.6	----	21	13,617	−57.9	----
125					20	15,141	−73.7	----	12	14,467	−54.7	----	12	15,025	−65.7	----	19	15,163	−71.1	----	7	14,811	−62.7	----	16	14,746	−58.8	----
100					6	16,459	−77.8	----					7	16,361	−68.3	----	13	16,464	−74.5	----					11	16,130	−61.2	----
80																									6	17,521	−61.8	----

Standard pressure surface (mb.)	El Paso, Tex. (882.9 mb.)				Ely, Nev. (806.3 mb.)				Glasgow, Mont. (937.0 mb.)				Grand Junction, Colo. (815.8 mb.)				Great Falls, Mont. (881.5 mb.)				Greensboro, N. C. (987.4 mb.)				Hatteras, N. C. (1,019.1 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	1,195	9.6	46	31	1,908	−8.0	75	31	648	−13.3	73	31	1,474	−1.9	64	31	1,128	−6.8	61	31	273	5.2	79	31	3	11.1	81
1,000	31	145	(*)	----	31	188	(*)	----	31	145	(*)	----	31	173	(*)	----	31	131	(*)	----	31	168	(*)	----	31	160	11.7	73
950	31	586	(*)	----	31	604	(*)	----	31	545	(*)	----	31	596	(*)	----	31	543	(*)	----	31	590	7.1	64	31	594	9.5	66
900	31	1,040	(*)	----	31	1,035	(*)	----	31	958	−7.4	64	31	1,032	(*)	----	31	969	(*)	----	31	1,034	5.6	64	31	1,036	7.6	64
850	31	1,511	9.8	41	31	1,491	(*)	----	31	1,404	−6.5	58	31	1,489	(*)	----	31	1,412	−5.3	51	31	1,500	4.4	59	31	1,505	5.8	63
800	31	2,012	7.6	41	31	1,969	−5.0	71	31	1,876	−8.3	56	31	1,976	−.5	49	31	1,886	−7.3	51	31	1,993	3.5	51	31	2,000	4.1	56
750	31	2,548	5.2	42	31	2,483	−4.9	59	31	2,381	−10.7	56	31	2,495	−2.8	50	31	2,391	−9.8	53	31	2,521	1.5	49	31	2,528	2.0	47
700	31	3,101	2.1	40	31	3,018	−7.1	54	31	2,902	−13.8	56	31	3,034	−6.2	54	31	2,916	−12.6	54	31	3,068	−.6	46	31	3,078	−.1	42
650	31	3,699	−1.6	38	31	3,597	−10.3	52	31	3,469	−17.0	52	31	3,615	−9.4	54	31	3,485	−16.0	50	31	3,658	−3.7	43	31	3,671	−2.9	42
600	31	4,328	−5.4	37	31	4,204	−13.6	50	31	4,058	−20.5	52	31	4,225	−12.9	52	31	4,076	−20.1	47	31	4,286	−7.4	42	30	4,290	−6.5	----
550	31	5,007	−9.7	36	31	4,862	−17.8	43	30	4,696	−24.7	----	31	4,886	−16.9	50	31	4,718	−24.5	----	31	4,959	−11.1	41	30	4,976	−10.2	----
500	31	5,735	−14.2	37	31	5,568	−22.3	----	30	5,382	−29.4	----	31	5,592	−21.6	----	31	5,402	−29.5	----	31	5,685	−15.9	42	29	5,702	−14.6	----
450	30	6,536	−19.2	41	31	6,337	−27.8	----	30	6,132	−34.9	----	31	6,368	−26.7	----	31	6,150	−34.8	----	30	6,422	−21.1	----	29	6,497	−20.2	----
400	30	7,397	−25.0	----	31	7,171	−33.7	----	30	6,937	−40.9	----	31	7,202	−32.1	----	31	6,958	−40.6	----	30	7,338	−27.3	----	29	7,354	−26.1	----
350	28	8,357	−32.1	----	30	8,094	−40.1	----	30	7,833	−46.9	----	31	8,132	−38.4	----	28	7,863	−46.9	----	30	8,285	−34.1	----	29	8,305	−33.3	----
300	28	9,426	−40.6	----	30	9,130	−46.9	----	29	8,835	−52.8	----	30	9,179	−45.5	----	28	8,870	−52.6	----	26	9,374	−41.2	----	28	9,370	−41.4	----
250	27	10,640	−50.1	----	30	10,319	−53.7	----	26	10,000	−55.8	----	29	10,378	−52.1	----	27	10,040	−55.9	----	26	10,589	−50.1	----	27	10,584	−49.5	----
200	24	12,058	−59.0	----	28	11,726	−58.0	----	24	11,422	−54.8	----	26	11,816	−56.4	----	25	11,459	−55.8	----	22	12,013	−58.2	----	23	12,042	−57.7	----
175	23	12,884	−61.8	----	27	12,563	−57.9	----	23	12,275	−53.9	----	23	12,663	−56.1	----	24	12,309	−54.1	----	17	12,840	−59.7	----	19	12,881	−60.1	----
150	22	13,836	−63.1	----	19	13,506	−57.8	----	22	13,268	−53.8	----	15	13,635	−55.5	----	21	13,272	−54.2	----	12	13,797	−60.1	----	11	13,853	−60.8	----
125	13	14,953	−66.5	----	18	14,658	−59.2	----	15	14,462	−53.2	----	9	14,782	−56.9	----	17	14,434	−54.2	----	9	14,944	−62.4	----	8	14,980	−63.3	----
100	9	16,283	−69.7	----	10	16,041	−61.1	----	11	15,878	−55.0	----	8	16,178	−58.2	----	10	15,880	−55.2	----								
80									8	17,304	−56.7	----					6	17,294	−56.3	----								

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during December 1948*—Continued

Standard pressure surface (mb.)	Havana, Cuba [1] (mb.)				Honolulu, T. H. (1,016.0 mb.)				International Falls, Minn. (969.8 mb.)				Joliet, Ill. (997.0 mb.)				Lake Charles, La. (1,018.6 mb.)				Lander, Wyo. (823.7 mb.)				Las Vegas, Nev. [1] (948.3 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface					31	3	23.3	68	31	360	−11.7	80	30	178	−2.3	80	31	5	13.2	83	31	1,096	−7.8	59	17	574	7.4	25
1,000					31	142	22.1	70	31	121	(*)	----	30	152	(*)	----	31	159	14.6	75	31	156	(*)	----	31	150	(*)	----
950					31	586	18.6	76	31	520	−10.3	77	30	564	−1.8	66	31	599	13.3	68	31	574	(*)	----	31	570	(*)	----
900					31	1,048	15.2	80	31	934	−9.5	72	30	991	−2.4	59	31	1,046	11.8	58	31	1,002	(*)	----	31	1,020	7.3	34
850					31	1,531	12.4	76	31	1,375	−9.7	66	30	1,444	−2.7	49	31	1,524	11.2	45	31	1,448	(*)	----	31	1,488	4.5	37
800					31	2,039	10.9	53	31	1,842	−11.0	61	30	1,923	−4.0	47	31	2,030	10.3	37	31	1,924	−4.2	48	31	1,980	2.1	38
750					31	2,582	8.9	36	31	2,343	−12.9	58	30	2,438	−6.0	43	31	2,576	8.0	35	31	2,435	−5.3	43	31	2,502	.1	36
700					31	3,143	6.3	----	31	2,859	−15.0	55	30	2,968	−8.2	41	31	3,131	4.9	35	31	2,970	−8.6	45	31	3,049	−2.5	31
650					31	3,751	3.1	----	31	3,426	−17.0	55	30	3,549	−10.9	40	31	3,736	1.5	36	31	3,546	−12.0	45	31	3,637	−5.7	30
600					31	4,391	−.7	----	31	4,014	−20.1	55	30	4,151	−14.5	44	31	4,372	−2.8	39	31	4,150	−15.2	43	31	4,256	−9.6	31
550					31	5,081	−5.1	----	31	4,658	−23.9	----	30	4,808	−18.7	47	31	5,056	−6.8	36	31	4,802	−19.5	43	31	4,924	−13.8	33
500					31	5,823	−9.6	----	31	5,344	−28.4	----	30	5,509	−23.6	----	31	5,794	−11.5	33	31	5,503	−24.5	----	31	5,642	−18.2	----
450					31	6,633	−15.5	----	31	6,096	−33.8	----	30	6,277	−28.9	----	31	6,605	−16.9	34	31	6,269	−30.0	----	31	6,422	−24.2	----
400					31	7,508	−21.3	----	31	6,905	−39.7	----	30	7,104	−34.4	----	31	7,470	−23.1	----	31	7,091	−36.1	----	31	7,268	−30.7	----
350					31	8,480	−28.2	----	31	7,805	−46.3	----	30	8,025	−40.6	----	30	8,436	−30.6	----	31	8,004	−42.9	----	31	8,203	−37.4	----
300					31	9,569	−35.2	----	31	8,812	−52.6	----	30	9,060	−46.9	----	29	9,510	−39.2	----	31	9,027	−50.0	----	31	9,251	−44.9	----
250					31	10,819	−42.2	----	31	9,980	−55.2	----	30	10,251	−52.8	----	28	10,730	−49.0	----	29	10,202	−54.6	----	30	10,449	−52.5	----
200					31	12,298	−51.3	----	31	11,406	−54.3	----	29	11,679	−55.7	----	27	12,165	−59.2	----	21	11,594	−55.8	----	29	11,871	−59.2	----
175					31	13,155	−56.6	----	30	12,259	−53.8	----	27	12,520	−56.3	----	25	12,996	−62.6	----	14	12,432	−55.3	----	27	12,708	−59.5	----
150					31	14,118	−62.4	----	26	13,250	−53.1	----	21	13,482	−56.5	----	22	13,944	−65.4	----	8	13,394	−53.1	----	26	13,672	−60.5	----
125					30	15,226	−67.9	----	23	14,425	−54.0	----	17	14,644	−58.9	----	16	15,044	−69.0	----	7	14,377	−55.3	----	20	14,808	−61.8	----
100					28	16,546	−72.6	----	20	15,854	−54.8	----	9	16,056	−58.7	----	13	16,370	−71.7	----					14	16,195	−65.0	----
80					22	17,841	−73.4	----	15	17,302	−56.4	----					7	17,674	−72.2	----								
60					14	19,537	−65.5	----																				
50					11	20,657	−60.8	----																				
40					9	22,052	−56.6	----																				

Standard pressure surface (mb.)	Little Rock, Ark. (1,009.3 mb.)				Mazatlan, Mexico (1,010.4 mb.)				Medford, Oreg. (971.1 mb.)				Merida, Mexico (1,013.6 mb.)				Miami, Fla. (1,018.4 mb.)				Nantucket, Mass. (1,016.8 mb.)				Nashville, Tenn. (998.2 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	79	7.4	73	31	14	21.9	83	29	401	2.2	80	31	27	23.9	81	31	4	21.2	85	30	14	3.4	75	31	177	6.2	76
1,000	31	154	8.1	67	31	104	21.5	80	29	162	(*)	----	31	145	24.3	80	31	162	22.0	77	30	149	3.9	67	31	161	(*)	----
950	31	579	7.4	60	31	561	22.9	58	29	582	2.5	69	31	595	22.0	78	31	610	19.3	77	30	569	2.0	68	31	585	5.8	66
900	31	1,022	6.6	55	31	1,021	21.1	47	29	1,014	.9	65	31	1,064	18.9	78	31	1,071	16.5	74	30	1,000	−.1	63	31	1,024	5.1	56
850	31	1,491	6.2	56	31	1,514	18.7	42	29	1,472	−1.6	66	31	1,553	16.2	73	31	1,556	14.4	69	30	1,456	−1.9	52	31	1,490	3.9	52
800	31	1,987	5.2	48	31	2,032	15.6	40	29	1,952	−4.5	67	31	2,068	14.1	64	31	2,067	12.1	61	30	1,937	−3.5	50	30	1,983	2.7	46
750	31	2,517	3.3	45	31	2,582	11.7	44	29	2,463	−7.1	59	31	2,614	12.0	49	31	2,609	10.1	46	30	2,452	−5.5	45	30	2,507	1.0	43
700	31	3,070	1.0	43	31	3,149	8.0	44	29	2,993	−9.8	54	31	3,187	9.3	42	31	3,177	7.3	39	30	2,985	−7.5	43	30	3,055	−1.6	42
650	31	3,665	−2.2	44	31	3,760	3.9	42	29	3,567	−13.0	47	31	3,800	5.8	37	31	3,785	3.9	33	30	3,565	−10.3	41	30	3,644	−5.0	39
600	31	4,294	−6.0	43	31	4,402	−.2	41	29	4,168	−16.7	47	30	4,448	1.7	35	31	4,429	.1	31	30	4,172	−13.4	42	30	4,267	−8.5	36
550	31	4,972	−10.4	43	30	5,095	−4.2	39	29	4,817	−20.7	----	30	5,143	−2.5	----	31	5,121	−3.9	28	29	4,832	−17.4	41	30	4,938	−12.5	36
500	31	5,697	−14.8	41	30	5,838	−8.9	34	29	5,514	−25.3	----	30	5,893	−7.6	----	30	5,866	−9.0	28	29	5,536	−21.7	----	30	5,658	−17.0	----
450	31	6,493	−19.9	39	29	6,657	−14.2	33	29	6,277	−30.7	----	30	6,711	−13.2	----	30	6,680	−14.8	26	29	6,312	−26.7	----	29	6,446	−22.3	----
400	31	7,351	−25.8	----	29	7,530	−20.3	35	29	7,100	−35.7	----	30	7,591	−19.5	----	28	7,556	−21.2	----	29	7,146	−32.2	----	29	7,296	−28.2	----
350	31	8,305	−32.5	----	29	8,505	−27.5	----	29	8,016	−41.9	----	30	8,567	−27.3	----	28	8,527	−28.6	----	28	8,092	−38.0	----	29	8,240	−34.6	----
300	30	9,374	−40.5	----	29	9,595	−35.9	----	29	9,043	−49.0	----	30	9,656	−36.1	----	27	9,611	−37.0	----	28	9,138	−45.0	----	29	9,300	−42.1	----
250	28	10,597	−49.0	----	29	10,835	−45.6	----	29	10,223	−54.6	----	30	10,895	−45.9	----	27	10,845	−46.9	----	26	10,341	−51.7	----	29	10,511	−50.7	----
200	22	12,032	−55.7	----	29	12,285	−56.1	----	28	11,646	−57.2	----	29	12,339	−57.3	----	26	12,291	−57.3	----	24	11,762	−56.5	----	29	11,937	−58.1	----
175	21	12,877	−58.9	----	26	13,128	−61.3	----	28	12,490	−57.2	----	29	13,172	−62.7	----	26	13,124	−61.6	----	18	12,575	−55.0	----	26	12,771	−58.9	----
150	17	13,831	−61.0	----	23	14,078	−65.1	----	25	13,460	−56.7	----	29	14,109	−67.9	----	23	14,068	−65.8	----	15	13,548	−55.3	----	20	13,724	−59.8	----
125	11	14,943	−62.4	----	19	15,188	−68.6	----	21	14,592	−56.4	----	24	15,196	−72.9	----	18	15,169	−69.4	----	12	14,706	−57.4	----	20	14,853	−63.0	----
100					14	16,525	−73.2	----	15	16,029	−58.8	----	15	16,491	−77.8	----	10	16,477	−73.9	----	6	16,178	−59.8	----	10	16,196	−63.5	----
80									6	17,445	−58.4	----													5	17,593	−66.3	----

Standard pressure surface (mb.)	New Orleans, La. (1,019.3 mb.)				North Platte, Nebr. (916.5 mb.)				Oakland, Calif. (1,018.5 mb.)				Oklahoma City, Okla. (970.6 mb.)				Omaha, Nebr. (980.0 mb.)				Phoenix, Ariz. (977.2 mb.)				Pittsburgh, Pa. (972.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	2	13.8	86	31	849	−4.4	77	31	6	8.2	81	31	391	5.2	59	31	308	−0.8	76	31	339	9.0	56	31	382	1.0	72
1,000	30	163	14.5	83	31	150	(*)	----	31	157	8.4	75	31	143	(*)	----	31	144	(*)	----	31	145	(*)	----	31	158	(*)	----
950	30	602	12.8	74	31	565	(*)	----	31	584	6.2	71	31	566	6.9	52	31	558	−1.0	63	31	579	13.9	36	31	575	1.2	67
900	30	1,050	12.0	60	31	992	−2.1	67	31	1,022	4.5	65	31	1,009	6.5	47	31	985	−1.3	57	31	1,030	11.5	36	31	1,007	−.3	60
850	30	1,529	11.7	43	31	1,447	−1.8	55	31	1,486	2.4	62	31	1,478	6.5	40	31	1,440	−1.7	50	31	1,505	8.3	38	31	1,463	−1.8	54
800	30	2,304	10.2	43	31	1,929	−2.7	48	31	1,974	.4	50	31	1,974	4.8	38	31	1,922	−3.3	47	31	2,003	5.4	40	31	1,944	−3.2	46
750	30	2,573	8.0	----	31	2,443	−5.1	45	31	2,497	−1.9	46	31	2,502	2.2	37	31	2,435	−5.4	46	31	2,534	3.1	34	31	2,459	−4.9	45
700	30	3,135	4.9	----	31	2,977	−8.0	46	31	3,035	−5.0	47	31	3,052	−.2	35	31	2,969	−8.3	46	31	3,085	.4	28	31	2,993	−7.2	44
650	30	3,737	1.6	----	31	3,557	−11.0	43	31	3,620	−8.3	45	31	3,649	−3.6	35	31	3,547	−11.1	46	31	3,679	−2.8	----	31	3,574	−9.8	47
600	30	4,376	−2.2	----	31	4,161	−14.7	42	31	4,231	−12.1	42	31	4,272	−7.4	32	30	4,148	−15.1	46	31	4,306	−7.0	----	31	4,181	−12.9	47
550	29	5,064	−6.3	----	31	4,816	−19.0	42	31	4,895	−16.3	39	31	4,948	−11.6	----	30	4,801	−19.3	45	31	4,984	−11.0	----	31	4,844	−16.7	45
500	29	5,803	−10.9	----	30	5,517	−23.7	----	30	5,609	−20.5	36	31	5,668	−16.6	----	30	5,502	−24.3	----	31	5,706	−16.1	----	31	5,550	−21.3	----
450	29	6,616	−16.3	----	30	6,258	−28.9	----	30	6,387	−25.8	----	31	6,459	−22.0	----	30	6,269	−29.3	----	31	6,497	−21.7	----	31	6,327	−26.3	----
400	28	7,482	−22.8	----	30	7,112	−34.6	----	30	7,224	−32.1	----	30	7,308	−28.0	----	30	7,096	−34.3	----	31	7,350	−27.8	----	31	7,162	−32.1	----
350	28	8,447	−30.2	----	30	8,031	−40.9	----	30	8,152	−39.0	----	30	8,253	−34.8	----	30	8,018	−40.5	----	31	8,296	−34.8	----	31	8,093	−38.4	----
300	28	9,524	−38.9	----	30	9,065	−47.3	----	30	9,193	−46.1	----	28	9,313	−42.5	----	30	9,054	−46.8	----	31	9,354	−42.5	----	30	9,137	−45.4	----
250	26	10,745	−48.8	----	27	10,245	−52.6	----	30	10,387	−52.7	----	25	10,535	−51.4	----	30	10,247	−52.1	----	30	10,563	−51.5	----	30	10,334	−51.9	----
200	25	12,178	−58.6	----	13	11,721	−56.7	----	28	11,796	−57.1	----	23	11,950	−59.7	----	25	11,687	−55.3	----	23	11,976	−58.9	----	30	11,764	−55.5	----
175	22	13,008	−62.8	----					28	12,638	−58.0	----	19	12,785	−60.3	----	20	12,524	−56.8	----	19	12,797	−60.6	----	27	12,612	−56.1	----
150	16	13,941	−65.7	----					26	13,611	−58.1	----	11	13,739	−60.7	----	15	13,506	−57.0	----	17	13,756	−61.6	----	22	13,593	−57.2	----
125	13	15,042	−67.5	----					21	14,759	−58.8	----					6	14,616	−57.8	----	13	14,871	−64.0	----	16	14,711	−58.3	----
100	7	16,382	−69.6	----					11	16,149	−60.7	----													14	16,097	−59.4	----
80																									7	17,460	−60.8	----

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during December 1948*—Continued

Standard pressure surface (mb.)	Portland, Maine (1,014.7 mb.)				Rapid City, S. Dak. (899.9 mb.)				St. Cloud, Minn. (976.6 mb.)				San Antonio, Tex. (989.8 mb.)				San Juan, P. R. (1,014.9 mb.)				Santa Maria, Calif. (1,009.9 mb.)				Sault Ste. Marie, Mich. (987.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	20	−1.8	74	31	980	−6.8	64	31	317	−9.1	78	31	240	12.5	69	31	15	24.1	82	31	71	8.7	78	31	221	−4.9	79
1,000	31	136	−.6	66	31	142	(°)	----	31	130	(°)	----	31	152	(°)	----	31	145	24.1	80	31	153	9.5	71	31	122	(°)	----
950	31	548	−2.3	61	31	555	(°)	----	31	537	−7.6	73	31	592	14.7	58	31	595	21.1	80	31	580	9.0	60	31	529	−5.2	77
900	31	972	−4.5	57	31	979	(°)	----	31	951	−6.3	59	31	1,043	13.3	51	31	1,061	17.9	80	31	1,025	7.1	53	31	950	−7.1	71
850	31	1,421	−5.9	55	31	1,430	−3.0	48	31	1,398	−6.3	56	31	1,523	12.4	44	31	1,549	14.7	77	31	1,493	5.3	46	31	1,394	−8.9	68
800	31	1,895	−7.8	53	31	1,908	−4.9	44	31	1,871	−7.7	58	31	2,031	11.6	38	31	2,060	12.1	68	31	1,986	3.3	41	31	1,861	−10.5	63
750	31	2,399	−9.6	49	31	2,419	−7.0	44	31	2,377	−9.5	54	31	2,574	9.0	38	31	2,603	10.0	52	31	2,515	1.1	39	31	2,362	−12.4	60
700	31	2,926	−11.3	47	31	2,948	−10.4	43	31	2,902	−11.9	49	31	3,136	5.6	38	31	3,170	7.4	42	31	3,059	−1.6	30	31	2,882	−14.1	57
650	31	3,497	−14.2	45	31	3,523	−13.4	40	31	3,472	−14.8	45	30	3,738	2.1	34	30	3,780	4.1	28	31	3,650	−4.6	29	31	3,447	−16.5	54
600	31	4,095	−18.0	42	31	4,121	−16.8	39	31	4,069	−18.0	42	30	4,378	−1.9	35	30	4,423	.2	----	31	4,271	−8.8	----	31	4,040	−19.6	51
550	31	4,741	−21.9	----	31	4,774	−20.9	----	31	4,718	−22.0	----	29	5,064	−6.3	35	30	5,115	−4.3	----	31	4,944	−13.0	----	31	4,685	−23.7	----
500	31	5,436	−26.1	----	31	5,466	−25.7	----	31	5,400	−26.7	----	29	5,802	−11.3	36	30	5,859	−9.3	----	30	5,667	−17.3	----	31	5,371	−28.3	----
450	31	6,198	−30.7	----	31	6,226	−30.7	----	31	6,165	−31.9	----	29	6,611	−16.7	41	30	6,673	−14.8	----	30	6,456	−22.8	----	31	6,128	−33.9	----
400	31	7,019	−35.7	----	31	7,047	−36.8	----	30	6,985	−37.6	----	29	7,478	−22.9	----	30	7,546	−20.9	----	30	7,302	−29.2	----	29	6,929	−39.2	----
350	31	7,936	−41.5	----	31	7,958	−43.2	----	29	7,889	−44.1	----	29	8,443	−29.9	----	29	8,520	−27.7	----	29	8,236	−36.0	----	28	7,836	−44.8	----
300	31	8,968	−47.3	----	30	8,989	−49.7	----	26	8,900	−50.0	----	29	9,522	−38.3	----	29	9,611	−35.2	----	29	9,290	−43.5	----	22	8,879	−50.5	----
250	30	10,155	−52.9	----	30	10,166	−54.6	----	19	10,066	−52.7	----	26	10,749	−48.1	----	29	10,850	−44.3	----	29	10,493	−51.6	----	13	10,087	−52.8	----
200	27	11,562	−55.2	----	25	11,589	−54.8	----	8	11,586	−54.7	----	17	12,188	−57.3	----	29	12,320	−54.6	----	28	11,921	−57.8	----	8	11,591	−55.6	----
175	26	12,408	−55.8	----	19	12,432	−54.0	----	----	----	----	----	7	13,018	−61.1	----	29	13,162	−60.4	----	27	12,760	−58.9	----	----	----	----	----
150	22	13,382	−55.6	----	15	13,401	−54.3	----	----	----	----	----	----	----	----	----	27	14,113	−66.1	----	23	13,723	−59.1	----	----	----	----	----
125	18	14,530	−56.2	----	6	14,584	−55.2	----	----	----	----	----	----	----	----	----	23	15,204	−71.2	----	20	14,867	−61.5	----	----	----	----	----
100	13	15,941	−57.5	----	----	----	----	----	----	----	----	----	----	----	----	----	5	16,478	−77.1	----	15	16,258	−63.4	----	----	----	----	----
90	5	17,349	−58.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	11	17,629	−63.1	----	----	----	----	----

Standard pressure surface (mb.)	Spokane, Wash. (929.8 mb.)				Swan Island, W. I.[1] (mb.)				Tacubaya, Mexico (774.9 mb.)				Tampa, Fla. (1,018.6 mb.)				Tatoosh Island, Wash. (1,008.7 mb.)				Toledo, Ohio (994.9 mb.)				Washington, D. C. (1,016.7 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	721	−5.9	84	----	----	----	----	31	2,306	15.1	50	31	9	18.5	89	31	31	4.1	87	31	191	−0.7	80	31	25	4.3	69
1,000	30	146	(°)	----	----	----	----	----	31	79	(°)	----	31	167	19.1	81	31	101	(°)	----	31	149	(°)	----	31	139	4.5	59
950	30	549	(°)	----	----	----	----	----	31	540	(°)	----	31	608	17.1	73	31	517	1.3	78	31	565	−1.3	69	31	580	3.3	55
900	30	976	−4.4	80	----	----	----	----	31	1,012	(°)	----	31	1,068	14.7	67	31	950	−1.2	76	31	990	−1.9	58	31	1,013	1.7	54
850	30	1,425	−5.7	71	----	----	----	----	31	1,509	(°)	----	31	1,549	12.2	65	31	1,403	−3.9	71	31	1,444	−2.9	49	31	1,473	.2	48
800	30	1,899	−8.1	65	----	----	----	----	31	2,032	(°)	----	31	2,056	10.2	58	31	1,879	−6.7	66	31	1,923	−4.2	45	31	1,957	−1.3	45
750	30	2,401	−10.8	63	----	----	----	----	31	2,582	14.2	48	31	2,594	8.3	47	31	2,385	−9.6	63	31	2,434	−6.1	44	31	2,479	−2.7	44
700	30	2,924	−14.2	61	----	----	----	----	31	3,162	9.9	54	31	3,159	6.2	53	31	2,910	−12.8	61	31	2,968	−8.3	43	31	3,015	−5.1	43
650	30	3,489	−17.8	58	----	----	----	----	31	3,776	5.2	60	31	3,764	2.7	29	30	3,474	−16.7	57	31	3,547	−11.3	44	31	3,603	−7.8	44
600	30	4,077	−21.4	----	----	----	----	----	31	4,423	.3	60	31	4,406	−1.2	27	30	4,065	−20.3	53	30	4,147	−14.7	44	31	4,212	−11.4	43
550	30	4,715	−25.5	----	----	----	----	----	31	5,118	−4.2	48	31	5,092	−5.3	----	30	4,702	−24.6	----	30	4,803	−18.6	45	31	4,879	−15.4	47
500	30	5,397	−30.2	----	----	----	----	----	31	5,861	−8.3	----	31	5,836	−10.4	----	30	5,391	−28.8	----	30	5,505	−23.0	----	31	5,588	−19.9	47
450	30	6,139	−35.3	----	----	----	----	----	31	6,684	−13.8	----	31	6,644	−15.8	----	30	6,139	−33.7	----	30	6,276	−28.3	----	31	6,367	−24.7	----
400	29	6,950	−41.1	----	----	----	----	----	31	7,557	−20.3	----	31	7,516	−22.3	----	29	6,952	−39.2	----	30	7,104	−34.1	----	31	7,210	−30.3	----
350	29	7,845	−47.3	----	----	----	----	----	30	8,531	−28.0	----	31	8,482	−29.8	----	29	7,856	−44.8	----	30	8,026	−40.5	----	31	8,147	−36.7	----
300	28	8,858	−52.1	----	----	----	----	----	29	9,619	−36.5	----	30	9,566	−38.3	----	29	8,875	−49.9	----	30	9,060	−47.2	----	31	9,197	−44.4	----
250	27	10,029	−55.5	----	----	----	----	----	29	10,857	−45.9	----	28	10,791	−48.5	----	29	10,054	−54.1	----	30	10,248	−53.2	----	29	10,390	−52.0	----
200	25	11,452	−54.2	----	----	----	----	----	27	12,304	−57.3	----	24	12,221	−59.1	----	27	11,479	−54.0	----	29	11,676	−56.4	----	28	11,810	−57.9	----
175	23	12,309	−53.6	----	----	----	----	----	23	13,134	−62.9	----	22	13,049	−63.1	----	21	12,331	−52.9	----	29	12,522	−56.7	----	28	12,648	−59.3	----
150	22	13,291	−53.6	----	----	----	----	----	15	14,084	−68.0	----	20	13,989	−66.4	----	18	13,328	−52.7	----	28	13,492	−57.5	----	27	13,611	−60.3	----
125	17	14,464	−53.6	----	----	----	----	----	5	15,151	−71.6	----	16	15,078	−70.8	----	13	14,499	−52.6	----	23	14,625	−58.5	----	26	14,744	−61.9	----
100	16	15,895	−54.6	----	----	----	----	----	----	----	----	----	11	16,387	−74.7	----	10	15,916	−53.3	----	20	16,017	−60.4	----	15	16,136	−62.9	----
90	10	17,334	−56.6	----	----	----	----	----	----	----	----	----	8	17,688	−73.9	----	6	17,410	−52.4	----	10	17,411	−61.2	----	11	17,521	−65.1	----
60	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	19,209	−62.7	----	----	----	----	----

See footnotes at end of table.

LATE REPORTS OF AEROLOGICAL DATA FOR NOVEMBER 1948

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during November 1948*—Continued

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Tacubaya, Mexico (773.5 mb.)				Swan Island, W. I. (1,011.5 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	2,306	16.0	62	30	10	26.7	81
1,000	30	58	(*)	----	30	112	26.9	79
950	30	521	(*)	----	30	571	23.5	83
900	30	997	(*)	----	30	1,036	20.3	79
850	30	1,492	(*)	----	30	1,528	17.5	73
800	30	2,014	(*)	----	30	2,045	14.9	63
750	30	2,568	14.8	60	30	2,595	12.1	51
700	30	3,148	10.6	64	30	3,165	9.2	47
650	30	3,766	5.9	72	30	3,783	5.7	41
600	30	4,414	1.1	76	30	4,426	2.3	37
550	30	5,110	−3.3	67	30	5,130	−1.8	----
500	30	5,859	−7.4	49	30	5,877	−6.1	----
450	30	6,684	−12.2	43	30	6,710	−10.8	----
400	29	7,564	−17.8	34	29	7,591	−16.6	----
350	29	8,548	−25.4	----	28	8,579	−24.0	----
300	29	9,647	−33.9	----	28	9,685	−32.4	----
250	28	10,896	−44.4	----	28	10,944	−42.6	----
200	27	12,353	−56.5	----	27	12,413	−54.5	----
175	25	13,188	−63.1	----	27	13,254	−61.4	----
150	15	14,116	−69.7	----	25	14,192	−68.6	----
125	9	15,188	−74.8	----	23	15,264	−76.1	----
100	7	16,481	−77.9	----	17	16,540	−80.1	----

*Temperature and relative humidity data for this level are not available or are available for certain days. See note entitled "Change in Summarization of Radiosonde Data," p. 6, in the January 1946 issue of the MONTHLY WEATHER REVIEW.

‡ Data not yet received.

§ Station elevation changed from 574 m. to 660 m., Dec. 18, 1948.

NOTE.—All observations scheduled between 0300 and 0500, G. C. T. except at Ciudad Victoria, Mazatlan, and Merida, where they are taken near 0200, G. C. T. "Number of observations" refers to those of dynamic height only. (In a few cases temperature or humidity data may be missing for one or more standard pressure surfaces of some observations.) Relative humidity data are not published for standard pressure surfaces having a corresponding mean temperature below −20° C.

All relative humidity observations are obtained by electric hygrometer and have been adjusted to compensate for the values occurring below the operating range of the humidity element. For explanation of the adjustment see article entitled "Curve Method for Obtaining Monthly Means of Relative Humidity," p. 241, MONTHLY WEATHER REVIEW, December 1944.

None of the means included in these tables are based on less than 15 observations at the surface or 5 observations at a standard pressure level.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T., during December 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (534 m.)			Albuquerque, N. Mex. (1,627 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (505 m.)			Boise, Idaho (868 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (100 m.)			Charleston, S. C. (16 m.)			Cincinnati, Ohio (273 m.)			Denver, Colo. (1,618 m.)			El Paso, Tex. (1,198 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	230	2.8	30	263	1.7	28	292	2.1	29	268	3.4	30	304	2.5	28	115	2.1	31	68	1.7	25	235	3.9	30	250	1.4	27	297	1.2	29	243	2.1	30	314	2.9	28	244	2.9
500							28	289	2.5										29	161	5.5	25	238	6.3	30	240	3.9	27	270	2.4	29	243	3.0						
1,000	30	236	5.1				26	279	4.9				30	276	5.6	28	123	1.9	27	182	3.9	22	244	9.8	28	270	5.4	25	252	3.7	23	269	4.7						
1,500	29	253	7.6				20	268	7.0	29	259	8.8	29	275	7.9	28	226	1.9	26	203	2.7	16	258	9.9	22	273	7.9	21	277	7.7	23	279	7.9				28	254	3.9
2,000	27	264	10.4	30	252	2.9	19	268	10.1	28	270	10.6	26	281	10.6	26	248	3.4	21	235	3.6	13	263	11.6	14	269	9.5	21	269	10.7	22	284	10.0	30	287	4.3	28	260	6.1
2,500	27	255	13.0	30	262	6.9	17	269	12.0	27	273	11.0	25	281	11.8	24	257	5.0	20	246	5.3				11	273	11.7	18	274	11.4	22	278	11.8	30	276	6.4	27	265	9.9
3,000	27	257	16.0	30	269	11.1	15	266	13.0	25	280	12.2	24	280	13.1	23	262	8.1	19	259	6.0				10	278	14.0	18	271	13.7	22	271	14.1	29	278	9.0	27	269	12.9
4,000	26	258	16.5	26	275	16.7	12	272	18.6	20	293	13.8	22	276	14.9	15	264	6.0	18	254	8.2				10	274	17.3	18	272	16.3	20	274	18.7	28	276	13.6	25	266	14.5
5,000	23	259	19.5	22	275	22.5				18	288	15.8	20	275	16.2	12	277	9.7	17	255	11.2							15	282	18.3	17	280	23.5	27	279	21.4	22	273	17.4
6,000	21	262	21.4	20	274	28.7				12	295	18.4	18	274	18.2	12	276	11.7	13	258	12.3							13	286	22.4	11	280	24.8	26	276	24.6	21	269	21.5
8,000				17	275	31.0							12	276	25.4				10	260	14.7													17	269	31.0	14	267	27.2
10,000				11	280	34.8																																	

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,475 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (575 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (416 m.)			Miami, Fla. (12 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (182 m.)			New York, N. Y. (15 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	29	177	1.5	31	270	1.2	26	277	1.0	29	243	2.7	31	45	0.5	27	242	3.9	31	246	1.0	27	252	0.4	27	332	0.7	31	122	1.9	30	00	0.0	29	258	1.0	25	292	4.1
500							26	261	2.0				31	269	2.1	27	249	5.1				27	236	2.1	27	346	.3	31	121	1.2	30	265	1.2	29	219	2.0	25	283	6.5
1,000							26	260	4.6	29	247	6.8	28	258	5.1	26	262	7.2	31	82	.2	24	221	4.0	27	175	1.6	31	245	.5	21	257	4.0	27	240	3.4	25	284	7.5
1,500				31	272	1.3	24	269	8.0	29	265	8.8	25	257	8.1	25	267	9.5	31	243	.4	22	245	6.2	24	211	3.3	28	264	1.9	18	272	7.6	20	241	6.1	22	294	10.1
2,000	29	183	1.7	31	235	2.9	23	277	10.9	29	270	9.1	21	255	9.1	22	273	12.4	30	240	3.1	20	258	9.6	21	238	3.3	25	250	3.4	17	275	9.6	17	262	8.1	21	284	13.6
2,500	29	214	4.0	31	225	5.4	22	276	13.3	26	275	10.1	17	254	10.9	21	274	14.8	28	259	5.7	19	269	12.2	16	250	3.0	22	258	4.1	14	276	10.8	16	270	10.8	19	281	16.2
3,000	25	247	6.8	31	240	7.7	22	273	14.7	23	279	10.2	17	259	11.7	19	275	16.7	27	268	8.1	15	267	13.8	13	304	3.5	20	260	4.5	13	280	12.4	16	269	13.4	15	276	16.2
4,000	21	267	11.3	22	269	12.5	20	281	19.6	13	279	12.4	14	270	11.4	18	271	20.6	27	271	13.8	11	269	20.3	10	297	3.3	18	274	5.5	13	275	16.2	16	268	17.7			
5,000	19	278	15.8	16	274	17.6	16	278	22.4				11	274	14.9	16	269	22.9	26	276	17.1				10	269	5.7	14	275	6.2	10	274	20.1	16	280	23.2			
6,000	18	269	18.5	12	281	21.2	14	278	25.2							13	265	24.5	24	277	21.1							13	283	5.4				13	283	26.9			
8,000	11	294	20.3																19	272	23.3							12	278	11.1									
10,000																												11	284	12.9									

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T., during December 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*—Continued

Altitude (meters) m. s. l.	Oakland, Calif. (8 m.)			Oklahoma City, Okla. (396 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Cloud, Minn. (318 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (240 m.)			San Diego, Calif. (13 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	27	226	1.2	29	216	2.4	27	250	1.2	31	245	0.9	28	307	3.8	28	232	2.0	29	225	0.9	30	192	0.3	30	264	2.5	29	261	2.4	28	206	2.5	27	204	3.0	28	276	2.0
500	27	276	.7	29	214	2.8	27	231	1.5	31	240	1.0	---	---	---	28	226	3.0	29	228	3.2	30	205	.8	30	242	1.6	29	248	3.9	28	209	5.0	---	---	---	28	269	4.5
1,000	24	307	2.5	29	216	4.8	25	245	5.5	31	239	1.4	28	307	3.9	27	242	5.1	26	242	6.3	28	234	2.0	29	193	2.3	21	277	5.2	22	225	6.7	26	203	4.8	26	274	7.4
1,500	20	318	4.6	27	244	8.4	24	250	8.3	29	241	2.4	28	300	6.2	24	255	6.5	23	253	8.3	26	250	4.5	29	197	2.4	13	292	5.7	20	229	7.4	19	225	5.6	24	283	10.7
2,000	19	323	5.3	26	259	10.4	23	256	10.2	28	264	4.0	28	287	7.6	21	271	8.1	20	264	10.4	22	255	8.0	26	259	2.9	12	306	7.3	16	230	6.6	15	234	5.9	23	279	13.2
2,500	19	311	6.7	26	261	13.8	22	259	11.6	25	267	6.2	27	289	9.8	21	271	9.7	20	266	12.3	20	261	10.5	24	267	3.5	10	315	8.9	14	256	5.6	13	237	6.5	20	279	15.3
3,000	18	313	8.5	26	263	16.2	22	261	13.0	24	268	8.7	25	290	11.7	20	275	12.1	19	267	13.6	20	266	12.6	24	279	6.0	10	317	11.3	13	252	4.9	12	241	6.4	20	276	18.5
4,000	17	298	10.6	22	270	19.4	19	266	15.6	22	274	12.4	24	280	14.8	19	278	15.4	18	264	19.0	19	269	15.6	21	278	10.4	---	---	---	10	263	5.2	---	---	---	17	280	20.0
5,000	14	304	11.5	16	277	23.4	15	273	16.9	18	276	14.4	22	280	17.3	17	281	19.3	14	268	18.5	15	267	17.3	19	278	11.8	---	---	---	10	268	6.7	---	---	---	12	288	22.0
6,000	12	290	12.2	12	285	24.5	15	273	20.4	13	277	15.0	18	291	20.7	15	282	25.2	10	276	17.2	12	272	20.6	16	279	13.2	---	---	---	---	---	---	---	---	---	11	290	22.0
8,000	---	---	---	---	---	---	---	---	---	---	---	---	14	286	27.3	---	---	---	---	---	---	---	---	---	13	270	18.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T., during December 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,636 m.)			Big Spring, Tex. (774 m.)			Bismarck, N. Dak. (505 m.)			Brownsville, Tex. (7 m.)			Caribou, Maine (191 m.)			Charleston, S. C. (13 m.)			Columbia, Mo. (237 m.)			Grand Junction, Colo. (1,473 m.)			Greensboro, N. C. (275 m.)			Hatteras, N. C. (3 m.)			International Falls, Minn. (358 m.)			Little Rock, Ark. (80 m.)			Miami, Fla. (12 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	31	107	0.3	30	183	3.2	31	301	1.4	31	137	1.3	31	276	2.0	31	315	0.5	31	126	1.2	31	133	0.4	31	270	0.8	31	346	2.0	31	215	1.1	31	300	0.3	31	72	1.1
500	---	---	---	---	---	---	---	---	---	31	154	4.7	31	275	4.4	30	250	2.3	31	208	3.4	---	---	---	31	262	2.1	31	302	2.3	31	233	1.8	31	207	3.0	31	112	2.2
1,000	---	---	---	30	216	6.8	29	286	5.8	31	171	4.0	31	282	5.5	28	264	4.0	31	244	6.5	---	---	---	31	262	4.3	31	282	3.3	31	254	4.1	31	229	5.8	31	132	1.6
1,500	---	---	---	30	243	10.0	29	291	7.9	31	179	2.9	31	280	7.1	28	268	6.2	31	256	8.6	31	144	.5	31	267	6.9	31	263	7.2	30	278	6.1	31	243	8.5	31	193	.9
2,000	31	260	4.1	30	261	11.8	29	286	9.9	31	238	2.8	30	283	8.9	27	271	8.8	31	259	9.7	31	222	2.7	31	272	9.0	31	266	8.7	29	285	6.9	31	247	11.0	31	232	1.9
2,500	31	267	7.4	30	263	12.3	29	288	11.0	31	246	4.8	30	274	10.5	27	269	12.0	31	263	11.9	31	222	5.5	31	265	10.8	30	270	9.7	30	286	8.1	31	251	12.5	31	247	2.9
3,000	31	267	10.4	30	262	13.1	30	285	11.8	31	246	5.7	29	269	12.2	26	271	14.0	31	265	14.3	31	236	9.1	30	275	13.0	30	270	12.8	30	289	9.0	31	255	14.7	31	258	3.3
4,000	30	269	14.4	29	262	15.2	30	283	13.6	31	256	8.1	27	273	13.8	26	273	15.5	30	271	18.3	31	265	13.1	28	273	17.6	28	274	15.5	30	284	12.8	29	259	19.5	31	279	5.3
5,000	29	277	18.1	27	259	20.5	30	282	14.6	31	262	9.8	27	272	17.1	25	276	18.7	27	264	20.3	29	273	17.3	27	268	21.9	26	268	18.1	28	269	13.1	29	260	23.9	30	281	7.2
6,000	27	270	21.7	23	264	21.2	30	286	17.6	31	265	11.6	26	264	18.6	22	276	20.6	24	267	23.8	25	277	16.7	26	272	25.0	24	268	20.4	26	267	12.4	27	259	24.6	28	282	8.7
8,000	15	261	22.6	11	248	26.1	23	279	18.2	28	253	15.1	16	252	21.4	18	284	27.2	17	271	32.0	15	289	23.6	16	286	26.6	15	276	23.2	20	249	12.7	18	261	28.7	28	282	13.8
10,000	---	---	---	---	---	---	15	275	18.9	27	259	16.8	12	265	22.1	11	285	29.3	---	---	---	---	---	---	10	290	34.5	10	278	27.8	16	270	19.0	11	262	32.8	24	280	15.3
12,000	---	---	---	---	---	---	---	---	---	21	258	24.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	13	267	17.6	---	---	---	22	283	18.9
14,000	---	---	---	---	---	---	---	---	---	12	258	26.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	16	283	19.7

Altitude (meters) m. s. l.	Nantucket, Mass. (13 m.)			Nashville, Tenn. (180 m.)			New Orleans, La. (6 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (392 m.)			Rapid City, S. Dak. (980 m.)			St. Cloud, Minn. (318 m.)			San Antonio, Tex. (242 m.)			San Juan, P. R. (28 m.)			Santa Maria, Calif. (72 m.)			Sault Ste. Marie, Mich. (221 m.)			Spokane, Wash. (726 m.)			Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	29	312	2.4	31	207	0.4	30	16	0.2	31	151	0.4	30	153	0.3	31	267	2.2	31	251	1.3	31	85	0.7	31	111	2.4	31	72	0.9	30	257	2.0	28	200	2.3	28	147	2.5
500	29	281	4.9	30	205	3.4	30	196	2.1	30	280	1.3	27	260	.4	---	---	---	28	255	2.4	31	166	1.8	31	90	7.3	30	4	2.5	30	261	3.6	---	---	---	25	222	3.2
1,000	28	272	5.4	30	235	6.1	29	226	3.5	30	302	2.5	25	263	3.5	31	268	2.3	28	270	5.0	31	214	2.9	31	94	7.6	30	336	3.5	29	277	6.1	28	218	4.3	24	240	5.1
1,500	28	269	8.6	30	246	7.8	29	250	6.2	30	297	3.7	24	280	6.1	31	290	5.6	27	282	6.3	31	242	4.9	31	94	7.2	29	335	4.1	28	288	7.2	28	240	6.3	24	254	5.8
2,000	28	264	12.1	30	257	9.9	29	255	9.2	30	292	5.3	25	273	8.8	31	295	8.0	27	282	9.0	31	255	7.6	30	95	6.9	29	324	5.8	27	283	7.4	27	249	6.1	24	262	5.3
2,500	28	272	13.0	30	264	12.0	29	260	11.0	30	288	7.2	26	277	11.6	31	289	9.1	27	277	10.6	31	253	9.6	29	93	6.4	29	317	6.7	27	281	9.8	25	255	6.4	24	271	5.8
3,000	28	271	15.3	30	261	15.6	29	262	12.7	31	284	8.5	27	272	13.0	31	285	10.3	28	276	11.2	31	256	11.3	26	93	4.9	29	301	8.3	25	278	12.1	23	264	6.6	25	265	6.7
4,000	26	273	19.2	28	261	18.9	27	265	15.5	31	282	12.1	27	272	17.7	31	285	13.2	28	273	13.4	29	257	14.4	24	87	2.8	29	289	11.1	25	274	16.8	20	276	9.7	25	281	8.4
5,000	20	270	22.5	20	263	18.5	27	266	19.0	28	291	14.8	25	277	20.3	30	282	15.9	26	276	13.6	26	262	16.5	22	92	2.8	28	283	14.0	20	276	16.5	16	274	9.9	22	297	8.7
6,000	13	268	23.4	19	260	22.3	25	265	21.4	23	287	18.7	24	268	23.9	26	285	18.8	24	274	15.6	21	258	17.2	23	78	2.6	26	274	15.2	19	274	19.4	15	270	12.3	21	302	9.1
8,000	---	---	---	13	264	32.6	19	267	25.1	20	276	21.4	16	275	28.8	22	282	20.3	16	270	13.3	17	254	21.9	22	3	3.1	22	263	18.4	11	271	22.9	---	---	---	16	321	10.8
10,000	---	---	---	---	---	---	16	262	27.9	10	264	25.9	11	270	33.4	16	283	23.8	12	278	15.6	13	261	25.8	22	279	9.7	14	258	22.6	---	---	---	---	---	---	12	324	13.8
12,000	---	---	---	---	---	---	11	271	29.8	---	---	---	---	---	---	11	268	27.8	---	---	---	---	---	---	22	276	18.5	11	265	25.2	---	---	---	---	---	---	11	304	14.2
14,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	19	282	15.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---

NOTE.—Resultants prepared from rawins at high altitudes are biased toward lower wind speeds. Values appearing in this table should therefore be used with caution when the number of observations missing is greater than three. See note following Table 3 in the June 1948 issue of the MONTHLY WEATHER REVIEW.

AEROLOGICAL OBSERVATIONS FOR THE YEAR 1948

TABLE 1A.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade and relative humidity in percent, for standard pressures, as obtained by radiosondes during the year 1948*

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Albany, N. Y. (1,006.6 mb.)				Albuquerque, N. Mex. (837.0 mb.)				Atlanta, Ga. (983.1 mb.)				Big Spring, Tex. (926.4 mb.)				Bismarck, N. Dak. (954.9 mb.)				Boise, Idaho (915.1 mb.)				Brownsville, Tex. (1,013.7 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	365	86	6.9	78	366	1,620	14.3	39	365	300	15.7	75	364	774	17.6	46	363	505	5.2	73	365	868	10.7	57	366	6	21.7	33
1,000	365	139	(*)	----	366	85	(*)	----	365	153	(*)	----	364	111	(*)	----	363	123	(*)	----	365	118	(*)	----	366	123	21.7	80
950	365	567	6.9	67	366	538	(*)	----	365	593	16.2	66	364	558	(*)	----	363	549	(*)	----	365	556	(*)	----	366	572	19.7	75
900	365	1,005	4.7	67	366	1,004	(*)	----	365	1,050	14.2	66	364	1,021	17.8	43	363	989	5.7	60	365	1,006	12.0	47	366	1,034	18.3	63
850	365	1,470	2.4	66	366	1,489	(*)	----	365	1,531	11.9	63	364	1,508	15.5	42	363	1,456	3.9	59	365	1,483	9.3	46	366	1,523	16.6	33
800	365	1,958	.2	63	366	2,001	13.1	37	365	2,037	9.4	58	364	2,020	12.6	43	363	1,947	1.7	57	365	1,982	5.7	49	366	2,038	14.7	45
750	365	2,479	−2.1	60	366	2,545	9.4	39	365	2,574	6.8	52	364	2,563	9.3	42	363	2,470	−1.0	57	365	2,509	1.9	53	366	2,586	12.1	49
700	365	3,019	−4.6	55	366	3,109	5.2	43	365	3,134	4.0	46	364	3,127	5.8	40	363	3,012	−4.0	55	365	3,059	−1.9	56	365	3,156	8.8	49
650	364	3,605	−7.2	52	366	3,711	.7	48	364	3,737	.8	46	364	3,733	1.9	39	363	3,597	−7.4	53	365	3,647	−5.9	56	365	3,767	5.0	41
600	363	4,219	−10.5	46	366	4,347	−4.1	51	363	4,372	−2.8	----	363	4,370	−2.5	----	363	4,212	−11.2	51	364	4,267	−9.9	57	365	4,413	1.0	----
550	363	4,887	−14.4	45	365	5,027	−8.8	52	362	5,058	−6.8	----	361	5,056	−7.0	----	363	4,877	−15.4	50	364	4,933	−14.4	56	364	5,107	−3.4	----
500	360	5,600	−19.0	47	365	5,758	−13.9	----	359	5,794	−11.4	----	361	5,792	−11.8	----	359	5,589	−20.1	51	362	5,648	−19.3	57	364	5,854	−8.3	----
450	358	6,383	−24.0	----	364	6,557	−19.1	----	359	6,601	−16.7	----	358	6,598	−16.9	----	354	6,369	−25.5	53	358	6,429	−24.6	----	363	6,671	−13.7	----
400	357	7,226	−29.8	----	362	7,417	−25.0	----	359	7,469	−22.8	----	356	7,467	−22.9	----	351	7,207	−31.6	----	354	7,273	−30.6	----	363	7,551	−19.9	----
350	352	8,163	−36.5	----	358	8,373	−31.8	----	357	8,434	−30.0	----	355	8,432	−29.9	----	344	8,138	−38.4	----	349	8,206	−37.5	----	360	8,525	−27.0	----
300	349	9,215	−43.7	----	353	9,446	−39.4	----	353	9,514	−38.2	----	354	9,513	−37.8	----	331	9,184	−45.5	----	347	9,254	−45.1	----	358	9,618	−35.3	----
250	326	10,419	−50.5	----	336	10,675	−47.6	----	348	10,743	−47.4	----	349	10,745	−46.6	----	303	10,386	−51.7	----	332	10,449	−51.9	----	350	10,861	−44.8	----
200	294	11,858	−55.6	----	297	12,158	−54.8	----	335	12,187	−56.0	----	311	12,195	−54.5	----	273	11,821	−54.3	----	294	11,883	−55.2	----	327	12,319	−54.9	----
175	----	----	----	----	----	----	----	----	319	13,029	−59.4	----	269	13,043	−57.7	----	261	12,676	−54.4	----	259	12,728	−55.0	----	303	13,162	−59.6	----
150	----	----	----	----	----	----	----	----	292	13,986	−62.5	----	----	----	----	----	236	13,670	−54.5	----	225	13,707	−55.6	----	262	14,118	−64.2	----
125	----	----	----	----	----	----	----	----	252	15,119	−65.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

	Buffalo, N. Y. (990.5 mb.)				Caribou, Maine (992.4 mb.)				Charleston, S. C. (1,016.5 mb.)				Ciudad Victoria, Mexico (973.0 mb.)				Columbia, Mo. (987.9 mb.)				Dodge City, Kans.[2] (924.2 mb.)				El Paso, Tex. (880.6 mb.)			
Surface	365	221	8.0	76	366	191	2.1	82	366	13	16.3	88	352	335	25.0	57	364	239	12.0	71	361	792	11.5	63	364	1,195	18.6	33
1,000	365	141	(*)	----	366	128	(*)	----	366	152	17.6	81	352	92	(*)	----	364	135	(*)	----	361	121	(*)	----	364	85	(*)	----
950	365	569	7.8	68	366	546	2.8	69	366	595	16.7	71	352	546	23.6	57	364	570	12.0	63	361	560	(*)	----	364	541	(*)	----
900	365	1,009	5.3	68	366	980	.6	68	366	1,051	14.6	68	352	1,014	20.0	60	364	1,018	9.9	62	361	1,012	12.9	55	364	1,012	(*)	----
850	365	1,474	2.9	66	366	1,437	−1.6	68	366	1,533	12.2	63	351	1,504	16.8	63	364	1,491	7.9	60	361	1,491	11.1	51	364	1,498	18.1	31
800	365	1,963	.6	62	366	1,918	−3.6	65	366	2,040	9.8	57	351	2,019	14.1	64	364	1,990	5.8	54	361	1,996	8.8	48	364	2,013	14.6	33
750	365	2,486	−1.6	57	366	2,431	−5.8	62	366	2,579	7.2	52	351	2,567	11.4	61	364	2,523	3.3	52	361	2,531	5.9	45	364	2,558	10.7	36
700	365	3,026	−4.2	54	366	2,964	−8.1	58	366	3,139	4.3	48	349	3,136	8.3	55	364	3,073	.5	50	361	3,089	2.5	45	364	3,125	6.4	38
650	364	3,614	−6.9	51	366	3,542	−10.8	54	365	3,743	1.0	47	343	3,748	4.5	49	362	3,669	−2.8	48	361	3,687	−1.3	44	364	3,729	1.8	43
600	363	4,229	−10.3	49	365	4,149	−14.0	52	363	4,379	−2.7	45	337	4,394	.7	46	362	4,295	−6.5	46	359	4,317	−5.5	44	364	4,368	−2.7	45
550	358	4,897	−14.2	46	364	4,805	−17.8	51	361	5,066	−6.7	----	331	5,090	−3.4	----	358	4,972	−10.7	43	359	4,994	−10.2	----	361	5,053	−7.3	46
500	355	5,611	−18.6	----	363	5,510	−22.4	53	358	5,803	−11.2	----	328	5,836	−8.2	----	358	5,097	−15.3	----	356	5,713	−15.2	----	358	5,788	−12.3	----
450	351	6,397	−23.7	----	362	6,281	−27.5	----	352	6,612	−16.5	----	326	6,657	−13.4	----	355	6,494	−20.6	----	355	6,516	−20.5	----	353	6,594	−17.6	----
400	344	7,242	−29.7	----	360	7,116	−33.1	----	350	7,481	−22.5	----	322	7,534	−19.4	----	354	7,348	−26.7	----	355	7,370	−26.7	----	351	7,459	−23.7	----
350	330	8,178	−36.3	----	356	8,041	−39.5	----	347	8,447	−29.5	----	320	8,512	−26.9	----	351	8,299	−33.5	----	355	8,320	−33.6	----	345	8,420	−30.8	----
300	317	9,232	−43.3	----	349	9,081	−45.7	----	344	9,528	−37.6	----	316	9,605	−35.4	----	341	9,366	−41.0	----	351	9,385	−41.3	----	340	9,496	−39.0	----
250	287	10,443	−50.1	----	334	10,280	−50.5	----	328	10,760	−47.2	----	276	10,853	−45.1	----	322	10,589	−49.0	----	336	10,603	−49.3	----	317	10,723	−48.1	----
200	246	11,881	−54.4	----	285	11,719	−52.7	----	310	12,208	−56.6	----	----	----	----	----	264	12,032	−55.1	----	305	12,046	−55.7	----	290	12,162	−56.3	----
175	188	12,767	−55.7	----	250	12,577	−52.7	----	295	13,049	−60.2	----	----	----	----	----	220	12,878	−57.2	----	253	12,891	−57.6	----	263	13,006	−59.9	----
150	----	----	----	----	170	13,604	−53.2	----	258	14,005	−63.3	----	----	----	----	----	168	13,876	−59.3	----	180	13,855	−59.5	----	235	13,965	−63.2	----
125	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	168	15,086	−67.3	----

	Ely, Nev. (807.8 mb.)				Fort Worth, Tex. (990.6 mb.)				Glasgow, Mont. (938.1 mb.)				Grand Junction, Colo. (851.5 mb.)				Great Falls, Mont. (885.3 mb.)				Greensboro, N. C. (986.5 mb.)				Hatteras, N. C. (1,017.7 mb.)			
Surface	365	1,908	7.2	48	305	211	19.9	58	366	648	6.4	62	366	1,474	10.9	48	366	1,128	7.2	56	363	273	12.9	71	365	3	16.9	33
1,000	365	105	(*)	----	305	127	(*)	----	366	115	(*)	----	366	105	(*)	----	366	110	(*)	----	363	157	(*)	----	365	152	16.9	78
950	365	551	(*)	----	305	574	19.3	54	366	545	(*)	----	366	551	(*)	----	366	546	(*)	----	363	593	13.8	66	365	593	14.9	71
900	365	1,006	(*)	----	305	834	16.7	56	366	988	7.5	54	366	1,010	(*)	----	366	996	(*)	----	363	1,046	11.7	65	365	1,046	12.6	66
850	365	1,483	(*)	----	305	1,520	14.2	56	366	1,457	5.3	53	366	1,488	(*)	----	366	1,463	6.6	50	363	1,522	9.3	65	365	1,524	10.3	61
800	365	1,989	9.2	----	305	2,030	11.8	52	366	1,950	2.5	55	366	1,995	10.1	41	366	1,958	3.4	53	363	2,023	7.1	61	365	2,027	8.1	56
750	365	2,524	6.1	43	305	2,573	8.9	46	366	2,474	.9	56	366	2,531	6.3	44	366	2,482	−.1	56	361	2,557	4.6	56	365	2,561	5.8	51
700	365	3,082	1.8	45	305	3,135	5.6	41	366	3,017	−4.0	56	366	3,090	2.2	49	366	3,027	−3.7	59	361	3,112	1.9	52	365	3,120	3.0	46
650	365	3,677	−2.6	48	304	3,742	1.8	----	366	3,602	−7.7	54	365	3,686	−2.3	54	366	3,613	−7.5	58	359	3,707	−1.3	49	360	3,718	−.2	47
600	365	4,304	−7.2	50	304	4,378	−2.4	----	366	4,216	−11.5	52	365	4,314	−6.9	57	363	4,227	−11.6	59	358	4,341	−4.9	47	356	4,353	−3.8	44
550	365	4,976	−12.0	52	302	5,067	−6.8	----	365	4,879	−15.8	49	365	4,988	−11.6	57	360	4,890	−16.2	57	355	5,022	−8.9	----	354	5,036	−7.9	42
500	363	5,698	−17.0	53	302	5,801	−11.5	----	363	5,590	−20.6	53	362	5,711	−16.6	56	359	5,600	−21.1	57	354	5,753	−13.4	----	351	5,770	−12.5	44
450	361	6,487	−22.3	----	299	6,610	−17.0	----	361	6,367	−26.1	----	359	6,503	−22.0	56	358	6,373	−26.7	58	349	6,554	−18.8	----	350	6,573	−17.7	----
400	357	7,337	−28.5	----	299	7,475	−23.1	----	358	7,203	−32.3	----	358	7,352	−28.1	----	356	7,208	−32.8	----	347	7,415	−24.7	----	347	7,438	−23.8	----
350	353	8,281	−35.2	----	299	8,438	−30.4	----	352	8,131	−39.2	----	353	8,298	−34.9	----	352	8,134	−39.6	----	343	8,373	−31.6	----	342	8,400	−30.7	----
300	346	9,337	−42.6	----	297	9,515	−38.6	----	344	9,169	−46.5	----	351	9,357	−42.5	----	348	9,172	−46.6	----	328	9,449	−39.4	----	335	9,475	−38.6	----
250	332	10,549	−50.3	----	293	10,743	−47.6	----	324	10,364	−52.6	----	342	10,569	−49.9	----	338	10,364	−52.8	----	314	10,672	−48.2	----	318	10,705	−47.5	----
200	306	11,986	−55.8	----	283	12,190	−55.9	----	283	11,798	−54.7	----	322	12,010	−55.3	----	302	11,793	−55.3	----	279	12,109	−56.3	----	284	12,153	−56.4	----
175	276	12,831	−57.1	----	269	13,032	−59.4	----	249	12,650	−54.0	----	296	12,858	−56.6	----	263	12,643	−54.3	----	256	12,952	−59.1	----	246	12,996	−59.4	----
150	224	13,811	−59.2	----	253	13,996	−62.6	----	227	13,643	−54.6	----	244	13,835	−58.2	----	220	13,630	−54.3	----	220	13,935	−61.8	----	190	13,956	−62.0	----
125	----	----	----	----	----	----	----	----	172	14,835	−55.1	----	179	14,975	−60.3	----	177	14,816	−55.8	----	155	15,059	−63.7	----	----	----	----	----

See footnotes at end of table.

TABLE 1A.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade and relative humidity in percent, for standard pressures, as obtained by radiosondes during the year 1948*—Continued

Standard pressure surface (mb.)	Honolulu, T. H. (1,014.4 mb.)				International Falls, Minn. (973.6 mb.)				Joliet, Ill. (995.6 mb.)				Lake Charles, La. (1,015.9 mb.)				Lander, Wyo. (827.4 mb.)				Las Vegas, Nev.[1] (945.3 mb.)				Little Rock, Ark. (1,007.2 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	366	3	25.7	64	366	360	2.5	78	365	178	8.2	78	365	5	18.5	83	366	1,696	6.6	51	352	574	20.2	22	365	79	15.4	75
1,000	366	129	23.8	66	366	141	(*)	----	365	140	(*)	----	365	140	19.4	76	366	105	(*)	----	366	83	(*)	----	365	139	17.0	70
950	366	579	20.1	72	366	561	4.2	69	365	570	8.8	67	365	586	17.6	70	366	546	(*)	----	366	533	(*)	----	365	579	15.5	62
900	366	1,040	16.6	76	366	997	2.6	66	365	1,012	6.9	64	365	1,043	15.6	65	366	1,001	(*)	----	366	998	19.7	----	365	1,034	13.3	63
850	366	1,525	13.8	74	366	1,459	.9	62	365	1,481	5.0	60	365	1,527	13.6	58	366	1,473	(*)	----	366	1,486	15.9	----	365	1,513	11.1	61
800	366	2,035	11.8	58	366	1,944	−1.1	58	365	1,974	3.0	57	365	2,036	11.6	51	366	1,974	7.7	44	366	1,997	11.9	28	365	2,018	9.1	56
750	366	2,580	10.0	42	366	2,462	−3.4	55	365	2,500	.7	53	365	2,579	9.1	46	366	2,507	4.4	43	366	2,537	7.8	30	365	2,555	6.7	50
700	366	3,144	7.4	----	366	3,000	−6.0	53	365	3,046	−.7	51	364	3,143	6.1	45	366	3,061	.4	47	366	3,097	3.5	33	365	3,114	3.7	47
650	366	3,755	4.2	----	366	3,581	−9.0	51	365	3,636	−4.5	48	362	3,749	2.6	42	366	3,654	−3.9	50	366	3,655	−.7	34	363	3,716	.4	46
600	366	4,398	.6	----	366	4,192	−12.6	50	365	4,257	−8.8	48	361	4,389	−1.4	----	366	4,278	−8.4	52	365	4,328	−5.1	36	362	4,351	−3.3	45
550	366	5,091	−3.5	----	366	4,854	−16.6	52	364	4,928	−12.8	48	361	5,077	−5.7	----	366	4,948	−13.2	53	365	5,007	−9.5	----	359	5,035	−7.5	42
500	365	5,837	−8.3	----	366	5,561	−21.2	50	363	5,646	−17.5	----	358	5,818	−10.5	----	366	5,665	−18.4	53	365	5,736	−14.4	----	358	5,770	−12.2	----
450	363	6,554	−13.9	----	364	6,337	−26.5	----	362	6,434	−22.8	----	353	6,628	−15.9	----	364	6,451	−24.1	51	365	6,533	−20.0	----	357	6,573	−17.5	----
400	363	7,532	−20.2	----	362	7,171	−32.5	----	362	7,281	−28.8	----	352	7,499	−22.1	----	363	7,292	−30.3	----	365	7,390	−25.8	----	354	7,439	−23.6	----
300	362	8,507	−27.3	----	359	8,100	−39.2	----	361	8,223	−35.5	----	350	8,467	−29.1	----	363	8,227	−37.3	----	360	8,341	−33.4	----	347	8,401	−30.6	----
350	362	9,509	−35.1	----	355	9,139	−46.1	----	355	9,231	−42.8	----	346	9,550	−37.4	----	363	9,275	−44.7	----	357	9,406	−41.3	----	335	9,476	−38.4	----
250	360	10,847	−43.6	----	339	10,338	−51.7	----	338	10,494	−49.9	----	337	10,782	−47.0	----	352	10,474	−51.7	----	350	10,621	−49.7	----	315	10,704	−47.0	----
200	359	12,315	−53.2	----	317	11,774	−53.2	----	284	11,934	−55.1	----	318	12,227	−56.7	----	296	11,906	−55.6	----	333	12,059	−56.1	----	279	12,187	−55.4	----
175	354	13,164	−58.3	----	297	12,635	−52.9	----	226	12,785	−56.4	----	301	13,067	−60.7	----	232	12,753	−56.0	----	303	12,901	−57.9	----	----	----	----	----
150	343	14,123	−63.3	----	262	13,607	−53.0	----	190	13,773	−57.8	----	279	14,019	−64.7	----	149	13,726	−56.7	----	238	13,864	−59.7	----	----	----	----	----
125	326	15,227	−67.5	----	201	14,835	−54.1	----	----	----	----	----	237	15,125	−68.8	----	----	----	----	----	----	----	----	----	----	----	----	----
100	295	16,564	−70.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
80	253	17,890	−69.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
60	203	19,632	−63.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
50	168	20,758	−60.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
40	118	22,169	−56.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Standard pressure surface (mb.)	Mazatlan, Mexico (1,008.4 mb.)				Medford, Oreg. (969.4 mb.)				Merida, Mexico (1,009.9 mb.)				Miami, Fla. (1,016.9 mb.)				Nantucket, Mass. (931.4 mb.)				Nashville, Tenn.[1] (996.3 mb.)				New Orleans, La. (1,016.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	358	14	25.4	75	364	401	11.9	67	365	27	26.1	75	364	4	23.4	83	348	14	8.5	86	361	177	14.9	70	359	2	19.1	83
1,000	358	88	24.8	73	364	138	(*)	----	365	122	25.6	75	364	151	23.3	80	348	143	9.4	80	361	146	(*)	----	359	143	19.7	78
950	358	544	23.4	60	364	574	12.1	61	365	573	23.2	73	364	600	20.6	80	348	573	8.7	71	361	584	14.0	64	359	587	17.8	72
900	358	1,009	21.7	53	364	1,021	9.6	59	365	1,043	20.4	73	364	1,064	17.8	76	348	1,015	6.6	65	361	1,036	11.6	63	359	1,047	15.9	66
850	358	1,503	19.0	49	363	1,493	6.3	62	365	1,535	17.3	73	364	1,552	15.2	71	348	1,483	4.5	60	361	1,512	9.4	62	359	1,531	13.8	58
800	358	2,022	15.9	49	363	1,987	3.1	64	365	2,051	14.3	69	363	2,064	12.7	62	348	1,975	2.5	56	360	2,014	7.1	58	359	2,041	11.6	52
750	358	2,573	12.5	48	363	2,513	.1	61	365	2,596	11.6	59	363	2,608	10.2	53	348	2,500	.4	51	359	2,548	4.6	53	359	2,593	9.1	47
700	357	3,142	8.7	48	363	3,057	−2.9	56	363	3,169	8.8	54	363	3,176	7.3	49	348	3,046	−1.9	48	359	3,103	2.0	48	358	3,147	6.2	46
650	356	3,754	4.6	50	363	3,645	−6.1	50	362	3,780	5.5	48	362	3,784	3.9	47	345	3,635	−5.0	47	356	3,700	−1.3	46	355	3,753	2.8	----
600	351	4,399	.4	----	360	4,263	−9.9	48	359	4,429	1.7	----	360	4,428	.1	48	343	4,258	−8.3	47	353	4,331	−4.9	43	350	4,396	−1.0	----
550	348	5,093	−4.0	----	359	4,929	−14.1	48	355	5,124	−2.5	----	359	5,121	−3.9	45	337	4,929	−12.2	----	351	5,012	−8.9	----	346	5,086	−5.2	----
500	346	5,839	−8.6	----	357	5,646	−18.9	49	351	5,875	−7.2	----	356	5,867	−8.5	----	332	5,650	−16.8	----	347	5,743	−13.5	----	341	5,827	−9.9	----
450	341	6,656	−13.8	----	353	6,429	−24.2	----	350	6,695	−12.6	----	353	6,684	−13.9	----	331	6,440	−21.9	----	340	6,544	−18.8	----	338	6,643	−15.2	----
400	340	7,534	−19.7	----	353	7,273	−30.2	----	347	7,578	−18.7	----	346	7,562	−20.0	----	327	7,290	−27.9	----	338	7,404	−24.9	----	335	7,514	−21.4	----
350	334	8,512	−27.0	----	352	8,210	−37.0	----	342	8,557	−26.2	----	344	8,537	−27.1	----	320	8,236	−34.3	----	331	8,361	−31.8	----	330	8,485	−29.4	----
300	333	9,604	−35.4	----	351	9,258	−44.4	----	341	9,652	−35.0	----	337	9,629	−35.5	----	310	9,298	−41.6	----	318	9,436	−39.5	----	324	9,581	−36.3	----
250	300	10,855	−44.9	----	347	10,460	−53.2	----	330	10,897	−45.0	----	331	10,871	−45.3	----	281	10,513	−49.0	----	294	10,662	−48.2	----	318	10,810	−46.1	----
200	206	12,318	−55.5	----	333	11,889	−55.7	----	256	12,359	−56.1	----	311	12,327	−55.7	----	230	11,960	−55.1	----	266	12,104	−56.1	----	309	12,261	−56.2	----
175	----	----	----	----	319	12,738	−56.2	----	215	13,192	−62.0	----	291	13,168	−60.7	----	182	12,858	−57.1	----	233	12,948	−58.8	----	285	13,103	−60.4	----
150	----	----	----	----	297	13,713	−56.9	----	----	----	----	----	244	14,119	−65.6	----	----	----	----	----	182	13,902	−60.7	----	262	14,053	−64.0	----
125	----	----	----	----	247	14,862	−58.4	----	----	----	----	----	169	15,222	−70.0	----	----	----	----	----	----	----	----	----	203	15,160	−67.5	----

Standard pressure surface (mb.)	North Platte, Nebr. (916.7 mb.)				Oakland, Calif. (1015.9 mb.)				Oklahoma City, Okla. (969.6 mb.)				Omaha, Nebr. (978.5 mb.)				Phoenix, Ariz. (971.9 mb.)				Pittsburgh, Pa. (972.4 mb.)				Portland, Maine (1014.3 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	366	849	8.9	67	366	6	13.3	75	365	391	14.5	67	363	308	11.4	68	364	239	21.8	35	363	382	10.1	71	364	20	5.7	79
1,000	366	116	(*)	----	366	138	12.8	72	365	126	(*)	----	363	131	(*)	----	364	89	(*)	----	363	146	(*)	----	364	136	7.0	72
950	366	553	(*)	----	366	575	12.2	63	365	564	15.6	59	363	563	10.8	62	364	542	24.3	26	363	580	9.8	68	364	561	6.0	66
900	366	1,002	10.6	60	366	1,022	11.7	51	365	1,021	13.7	57	363	1,010	8.8	60	364	1,007	20.9	26	363	1,023	7.8	66	364	999	3.8	66
850	366	1,477	8.7	56	366	1,498	9.7	45	365	1,501	11.8	54	363	1,482	6.9	57	364	1,498	17.0	29	362	1,493	5.3	65	364	1,462	1.6	65
800	366	1,976	6.1	55	366	2,000	7.4	37	365	2,007	9.7	50	363	1,979	4.8	54	364	2,011	13.0	32	361	1,986	3.0	62	364	1,949	−.5	62
750	366	2,507	3.2	54	366	2,535	4.7	----	365	2,545	7.0	47	363	2,508	2.2	50	364	2,555	8.9	34	361	2,514	.6	58	364	2,457	−2.8	58
700	366	3,059	−.1	54	366	3,087	1.5	----	365	3,105	3.9	44	363	3,057	−.9	49	364	3,117	5.0	35	360	3,058	−2.1	55	364	3,007	−5.1	54
650	365	3,652	−4.0	52	364	3,684	−2.0	----	365	3,706	.2	43	363	3,650	−4.4	49	363	3,721	1.1	35	357	3,649	−5.1	52	362	3,590	−8.0	52
600	363	4,276	−8.2	51	364	4,312	−5.9	----	364	4,341	−4.0	42	361	4,272	−8.2	48	360	4,356	−3.2	----	356	4,269	−8.4	51	361	4,205	−11.4	50
550	362	4,948	−12.7	51	364	4,991	−10.2	----	358	5,021	−8.5	42	360	4,945	−12.5	48	360	5,042	−7.8	----	354	4,943	−12.3	49	360	4,868	−15.2	51
500	361	5,667	−17.7	----	362	5,717	−15.0	----	351	5,753	−13.3	----	360	5,664	−16.6	----	356	5,774	−12.8	----	352	5,661	−16.7	----	357	5,582	−19.7	52
450	360	6,455	−23.1	----	360	6,513	−20.5	----	343	6,553	−18.7	----	358	6,453	−22.7	----	351	6,579	−18.4	----	347	6,455	−21.9	----	355	6,361	−24.9	----
400	359	7,299	−29.3	----	360	7,367	−26.8	----	337	7,415	−24.8	----	358	7,301	−28.7	----	349	7,439	−24.6	----	346	7,304	−27.9	----	352	7,203	−30.8	----
350	354	8,239	−36.0	----	358	8,317	−33.8	----	327	8,375	−31.6	----	356	8,243	−35.6	----	341	8,399	−31.9	----	344	8,250	−34.5	----	348	8,138	−37.2	----
300	349	9,294	−43.4	----	357	9,380	−41.6	----	311	9,448	−39.3	----	353	9,299	−43.1	----	336	9,472	−39.9	----	336	9,311	−42.0	----	344	9,186	−44.1	----
250	342	10,501	−50.5	----	352	10,595	−49.5	----	273	10,673	−47.7	----	350	10,506	−50.5	----	323	10,693	−48.5	----	321	10,523	−49.7	----	334	10,388	−50.5	----
200	298	11,940	−55.8	----	335	12,032	−55.4	----	221	12,134	−55.3	----	318	11,947	−55.4	----	295	12,135	−55.9	----	292	11,966	−55.6	----	309	11,817	−54.5	----
175	254	12,806	−56.8	----	325	12,880	−56.9	----	185	13,038	−59.1	----	269	12,797	−56.4	----	262	12,970	−58.6	----	262	12,809	−57.1	----	292	12,666	−55.4	----
150	203	14,234	−58.3	----	306	13,855	−58.4	----	----	----	----	----	222	13,800	−58.1	----	186	13,960	−61.9	----	220	13,775	−58.7	----	263	13,641	−56.2	----
125	----	----	----	----	250	14,994	−60.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	219	14,821	−57.8	----
100	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	171	16,243	−58.2	----

See footnotes at end of table.

TABLE 1A.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meters, temperature in degrees centigrade and relative humidity in percent, for standard pressures, as obtained by radiosondes during the year 1948*—Continued

Standard pressure surface (mb.)	Rapid City, S. Dak. (901.9 mb.)				St. Cloud, Minn. (977.7 mb.)				San Antonio, Tex. (984.4 mb.)				San Juan, P. R. (1,014.5 mb.)				Santa Maria, Calif. (1,008.0 mb.)				Sault Ste. Marie, Mich. (989.3 mb.)				Spokane, Wash. (931.0 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	362	980	6.4	68	366	317	5.1	78	366	240	19.9	66	365	15	25.3	81	366	71	12.7	76	360	221	3.4	83	364	721	8.6	65
1,000	362	117	(*)	----	366	130	(*)	----	366	122	(*)	----	365	141	24.5	81	366	135	12.6	75	366	132	(*)	----	364	124	(*)	----
950	362	551	(*)	----	366	558	6.5	67	366	571	19.6	61	365	593	21.3	82	366	570	12.9	63	366	555	4.5	70	364	555	(*)	----
900	362	996	(*)	----	366	994	5.1	62	366	1,031	17.2	62	365	1,058	18.2	81	366	1,020	13.5	46	366	990	2.8	66	364	1,001	7.7	63
850	362	1,469	8.1	52	366	1,460	3.4	59	366	1,526	14.9	60	365	1,546	15.3	78	366	1,500	11.7	42	366	1,451	.6	65	364	1,470	4.8	61
800	362	1,968	5.3	52	365	1,950	1.3	57	366	2,029	12.7	53	365	2,059	13.1	66	366	2,005	9.0	36	366	1,936	−1.5	63	364	1,961	1.8	62
750	362	2,497	2.3	52	365	2,473	.3	54	366	2,574	10.2	45	365	2,604	10.9	51	366	2,541	6.4	----	366	2,454	−3.7	58	363	2,482	−1.7	63
700	362	3,046	−1.1	52	365	3,016	−3.6	51	366	3,140	7.1	41	365	3,173	8.1	45	366	3,099	3.5	----	366	2,991	−6.1	55	363	3,024	−5.1	63
650	362	3,638	−4.8	51	365	3,602	−6.8	49	362	3,748	3.5	38	364	3,785	4.8	----	364	3,699	.1	----	364	3,573	−9.1	53	363	3,606	−8.6	59
600	361	4,259	−9.0	51	364	4,219	−10.5	49	361	4,390	−.6	----	363	4,430	1.2	----	362	5,016	−8.1	----	362	4,847	−16.4	51	361	4,880	−16.6	57
550	361	4,929	−13.4	50	363	4,885	−14.5	47	358	5,081	−5.0	----	361	5,127	−2.8	----	360	5,748	−13.0	----	355	5,555	−20.9	50	361	5,589	−21.3	57
500	360	5,646	−18.2	49	362	5,601	−19.1	50	357	5,821	−9.8	----	359	5,874	−7.3	----	359	6,551	−18.6	----	350	6,335	−26.1	----	360	6,363	−26.6	57
450	358	6,429	−23.8	49	360	6,382	−24.5	----	356	6,626	−15.3	----	355	6,696	−12.7	----	359	6,551	−18.6	----	350	6,335	−26.1	----	357	7,198	−32.6	----
400	356	7,273	−30.1	----	358	7,226	−30.5	----	356	7,506	−21.5	----	352	7,575	−18.9	----	358	7,411	−25.0	----	346	7,170	−32.0	----	356	8,126	−39.4	----
350	355	8,210	−37.0	----	354	8,161	−37.4	----	350	8,476	−28.6	----	351	8,555	−26.1	----	353	8,364	−32.1	----	335	8,105	−38.3	----	351	9,165	−46.4	----
300	347	9,259	−44.3	----	344	9,209	−44.5	----	344	9,561	−36.6	----	346	9,653	−34.3	----	350	9,435	−40.1	----	306	9,159	−44.9	----	340	10,358	−52.5	----
250	338	10,459	−50.9	----	318	10,416	−50.6	----	326	10,799	−45.6	----	343	10,903	−43.8	----	335	10,657	−48.7	----					301	11,792	−53.9	----
200	323	11,897	−54.2	----	257	11,860	−53.7	----	297	12,252	−55.1	----	341	12,365	−54.8	----	270	12,940	−58.0	----					279	12,640	−53.4	----
175	303	12,749	−54.7	----	211	12,740	−53.8	----	274	13,102	−59.0	----	327	13,207	−60.7	----	244	13,906	−60.0	----					261	13,644	−53.9	----
150	257	13,728	−55.2	----									287	14,154	−66.6	----	207	15,242	−72.0	----								
125	184	14,385	−56.4	----									207	15,242	−72.0	----	208	15,037	−62.8	----								

Standard pressure surface (mb.)	Swan Island, W. I. (1,012.7 mb.)				Tacubaya, Mexico (773.8 mb.)				Tampa, Fla. (1,016.7 mb.)				Tatoosh Island, Wash. (1,012.3 mb.)				Toledo, Ohio (994.1 mb.)				Washington, D. C. (1,015.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	328	10	26.3	82	358	2,306	16.6	58	361	9	21.5	84	365	31	9.0	86	365	191	8.6	77	366	25	12.9	72
1,000	328	121	25.8	81	358	56	(*)	----	361	153	21.5	80	365	132	(*)	----	365	140	(*)	----	366	154	12.9	66
950	328	578	22.3	83	358	519	(*)	----	361	600	19.3	76	365	559	6.9	75	365	569	7.1	67	366	587	11.4	60
900	328	1,041	19.5	77	358	996	(*)	----	361	1,061	16.7	73	365	998	4.9	71	365	1,012	6.4	65	366	1,035	9.2	61
850	328	1,532	16.7	71	358	1,493	(*)	----	361	1,547	14.0	69	365	1,463	2.6	67	365	1,480	4.3	62	366	1,508	7.0	59
800	328	2,047	14.1	62	358	2,020	(*)	----	360	2,056	11.5	61	365	1,951	.2	63	365	1,972	2.1	58	366	2,005	4.8	57
750	328	2,598	11.6	55	358	2,572	14.8	58	358	2,597	8.9	53	365	2,471	−2.5	59	365	2,497	−.1	54	366	2,534	2.5	53
700	327	3,164	8.6	----	358	3,152	10.3	64	358	3,162	6.0	48	365	3,011	−5.4	55	365	3,041	−2.5	50	365	3,085	−.2	50
650	326	3,780	5.2	----	358	3,767	5.6	70	358	3,767	2.6	45	362	3,593	−8.9	53	364	3,632	−5.7	49	364	3,678	−3.3	50
600	325	4,423	1.5	----	357	4,414	.8	74	357	4,409	−1.1	44	361	4,205	−12.5	53	363	4,249	−9.2	47	364	4,304	−6.8	----
550	324	5,123	−2.5	----	355	5,111	−3.7	71	356	5,097	−5.1	----	360	4,858	−16.6	53	362	4,920	−13.2	48	361	4,980	−10.8	46
500	322	5,870	−7.0	----	354	5,857	−8.1	----	355	5,841	−9.6	----	359	5,575	−21.1	52	361	5,638	−17.7	----	359	5,704	−15.4	----
450	321	6,692	−12.0	----	350	6,678	−13.1	----	355	6,653	−14.9	----	356	6,351	−26.4	53	357	6,425	−23.1	----	358	6,497	−20.6	----
400	318	7,577	−17.9	----	347	7,557	−19.0	----	355	7,528	−21.0	----	354	7,186	−32.3	----	356	7,271	−29.1	----	358	7,353	−26.6	----
350	316	8,560	−25.2	----	333	8,536	−26.5	----	350	8,499	−28.2	----	351	8,116	−38.6	----	350	8,211	−35.8	----	354	8,304	−33.5	----
300	315	9,661	−33.6	----	326	9,630	−35.1	----	344	9,586	−36.5	----	348	9,158	−44.8	----	342	9,268	−43.2	----	352	9,367	−41.4	----
250	313	10,913	−43.5	----	285	10,876	−45.0	----	335	10,822	−46.3	----	340	10,359	−50.8	----	330	10,469	−50.5	----	336	10,582	−49.6	----
200	310	12,376	−54.9	----					318	12,269	−56.5	----	322	11,801	−52.9	----	298	11,907	−55.5	----	303	12,007	−56.3	----
175	303	13,216	−61.4	----					307	13,107	−61.2	----	296	12,657	−52.3	----	275	12,755	−56.9	----	285	12,857	−58.5	----
150	276	14,157	−68.1	----					287	14,054	−65.5	----	275	13,654	−52.4	----					241	13,817	−59.9	----
125	154	15,243	−74.1	----					231	15,150	−69.7	----	241	14,831	−53.6	----					180	14,945	−61.8	----
100													193	16,272	−54.0	----					122	16,294	−62.5	----

*Temperature and relative humidity data for this level are not available or are available only for certain days. See note entitled "Change in Summarization of Radiosonde Data," p. 6, in the January 1946 issue of the MONTHLY WEATHER REVIEW.

[1] Station elevation changed from 574 m. to 660 m., Dec. 18, 1948.

[2] Station elevation changed from 787 m. to 792 m., Apr. 28, 1948.

[3] Station elevation changed from 180 m. to 177 m., July 18, 1948.

NOTE.—All observations scheduled between 0300 and 0500, G. C. T. except at Ciudad Victoria, Mazatlan, and Merida, where they are taken near 0200, G. C. T. "Number of observations" refers to those of dynamic height only. (In a few cases temperature or humidity data may be missing for one or more standard pressure surfaces of some observations.) Relative humidity data are not published for standard pressure surfaces having a corresponding mean temperature below −20° C.

All relative humidity observations are obtained by electric hygrometer and have been adjusted to compensate for the values occurring below the operating range of the humidity element. For explanation of the adjustment see article entitled "Curve Method for Obtaining Monthly Means of Relative Humidity," p. 241, MONTHLY WEATHER REVIEW, December 1944.

None of the means included in these tables are based on less than 15 observations at the surface or 5 observations at a standard pressure level.

TABLE 2A.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T., during year 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (534 m.)			Albuquerque, N. Mex. (1,627 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (505 m.)			Boise, Idaho (868 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (100 m.)			Charleston, S. C. (16 m.)			Cincinnati, Ohio (273 m.)			Denver, Colo. (1,618 m.)			El Paso, Tex. (1,198 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	353	180	1.8	365	236	2.0	339	280	0.8	---	---	---	358	274	0.7	---	---	---	354	120	3.7	330	254	2.7	327	266	1.0	333	164	1.1	353	256	1.8	358	1	0.7	363	243	2.3
500	---	---	---	---	---	---	339	279	1.1	---	---	---	---	---	---	---	---	---	346	132	4.7	330	252	4.0	327	252	2.3	332	198	2.0	353	252	2.5	---	---	---	---	---	---
1,000	352	188	2.6	---	---	---	332	266	1.9	---	---	---	356	272	2.2	---	---	---	307	151	3.4	299	252	5.3	318	270	3.8	313	236	2.8	347	256	3.5	---	---	---	---	---	---
1,500	334	207	3.2	---	---	---	304	270	3.4	---	---	---	332	274	3.7	---	---	---	282	171	1.8	245	262	5.8	283	275	5.8	296	262	4.2	308	263	4.7	---	---	---	363	242	2.9
2,000	322	229	4.3	365	243	2.8	285	275	4.8	---	---	---	305	273	5.1	---	---	---	253	192	1.3	221	268	6.9	244	283	7.4	279	271	5.5	271	272	6.0	358	349	.7	363	242	3.3
2,500	313	240	5.2	365	254	3.7	259	280	6.0	---	---	---	281	278	6.7	---	---	---	240	226	1.2	---	---	---	214	288	8.9	265	273	6.4	247	276	7.6	349	283	1.2	356	248	4.2
3,000	303	249	6.3	360	263	5.0	242	280	7.0	---	---	---	265	279	8.3	---	---	---	220	245	1.4	---	---	---	---	---	---	250	271	7.3	217	277	9.3	341	270	2.6	353	255	5.3
4,000	280	262	8.4	341	269	7.8	203	281	9.5	---	---	---	238	284	11.0	---	---	---	205	258	2.3	---	---	---	---	---	---	222	272	9.4	165	281	10.8	320	277	6.5	338	261	7.1
5,000	254	267	10.8	315	270	9.9	168	284	10.9	---	---	---	205	282	12.4	---	---	---	185	266	3.7	---	---	---	---	---	---	193	276	11.0	---	---	---	292	278	10.1	318	262	8.9
6,000	219	269	12.2	305	270	12.1	140	284	11.7	---	---	---	167	281	14.1	---	---	---	171	269	5.2	---	---	---	---	---	---	---	---	---	---	---	---	250	276	12.9	287	265	10.4
8,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	178	277	14.5	240	268	12.9
10,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	163	275	14.4

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,475 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (575 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (416 m.)			Miami, Fla. (12 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (182 m.)			New York, N. Y. (15 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	358	212	2.1	365	266	1.7	324	266	0.7	---	---	---	334	82	1.9	343	252	1.5	366	198	1.3	342	148	0.4	---	---	---	360	119	3.1	339	161	0.8	347	259	1.0	330	259	1.4
500	---	---	---	---	---	---	324	252	1.4	---	---	---	334	118	.8	343	252	2.1	---	---	---	342	212	1.0	---	---	---	360	118	3.7	337	194	1.1	347	244	1.7	330	263	3.3
1,000	---	---	---	---	---	---	324	257	2.6	---	---	---	308	232	1.7	264	247	3.1	366	191	2.1	320	231	1.9	---	---	---	355	125	2.2	288	263	.8	330	248	2.7	316	285	4.9
1,500	---	---	---	365	265	1.8	313	269	4.1	---	---	---	293	249	3.6	261	261	5.3	366	200	2.5	294	256	3.2	---	---	---	335	149	1.1	264	302	2.0	298	256	3.7	303	290	6.6
2,000	358	212	2.4	365	256	2.5	289	277	6.0	---	---	---	264	258	4.7	261	269	6.8	363	218	3.3	272	269	4.4	---	---	---	312	208	.8	236	294	3.3	275	272	4.5	277	288	8.3
2,500	358	222	3.3	362	244	3.3	271	280	7.6	---	---	---	248	262	5.5	230	272	8.0	360	232	3.9	251	278	5.6	---	---	---	276	224	1.0	205	289	4.4	251	277	5.8	237	289	9.3
3,000	345	235	3.8	353	244	4.6	249	282	9.3	---	---	---	228	269	6.3	213	279	9.3	356	247	4.6	231	279	6.6	---	---	---	255	241	1.5	184	286	5.1	232	279	7.5	177	290	8.9
4,000	303	254	5.1	317	258	6.4	222	282	12.0	---	---	---	195	271	7.5	143	279	11.2	345	261	6.8	184	286	8.6	---	---	---	228	254	2.7	151	280	7.7	199	281	9.7	---	---	---
5,000	269	268	7.7	283	264	8.4	179	281	13.8	---	---	---	144	270	9.0	---	---	---	328	266	9.3	---	---	---	---	---	---	189	256	3.6	---	---	---	158	288	12.1	---	---	---
6,000	236	268	9.7	250	268	10.5	---	---	---	---	---	---	---	---	---	---	---	---	314	272	10.5	---	---	---	---	---	---	152	257	3.9	---	---	---	---	---	---	---	---	---
8,000	171	270	12.0	181	269	13.9	---	---	---	---	---	---	---	---	---	---	---	---	248	271	14.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Altitude (meters) m. s. l.	Oakland Calif. (8 m.)			Oklahoma City, Okla. (396 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Cloud, Minn. (318 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (240 m.)			San Diego, Calif. (13 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	351	267	3.8	341	184	2.0	353	205	0.6	366	243	0.9	354	340	0.9	343	242	1.2	346	254	0.9	350	134	1.5	359	273	3.5	306	286	2.5	---	---	---	---	---	---	342	263	1.2
500	351	288	3.0	341	183	2.3	353	206	1.1	356	243	1.4	---	---	---	343	244	1.6	346	250	1.7	350	139	1.9	359	279	2.9	306	282	3.1	---	---	---	---	---	---	342	263	2.7
1,000	327	303	2.4	338	195	3.2	342	232	2.5	366	236	1.9	354	344	1.2	334	253	2.8	324	249	3.1	338	147	2.0	334	277	1.5	282	281	3.8	---	---	---	---	---	---	325	257	4.3
1,500	309	304	2.6	320	217	4.2	325	250	3.8	364	225	2.2	354	306	2.3	312	259	4.2	305	262	4.6	322	169	1.7	314	289	1.3	233	284	4.4	---	---	---	---	---	---	314	274	5.7
2,000	299	307	2.7	301	237	5.3	299	261	5.6	356	231	2.8	332	283	3.4	278	272	5.7	284	270	6.0	301	211	1.9	299	288	2.0	217	283	5.2	---	---	---	---	---	---	294	282	7.7
2,500	296	303	3.3	284	249	6.9	280	270	7.2	351	239	3.5	308	276	5.3	251	279	7.0	259	275	7.4	277	244	2.9	290	280	2.5	196	292	6.3	---	---	---	---	---	---	271	282	9.8
3,000	288	304	3.8	271	261	8.2	272	276	8.3	347	246	4.4	288	279	7.1	236	289	6.6	238	279	8.7	261	257	3.9	285	273	3.7	181	292	7.7	---	---	---	---	---	---	259	282	11.8
4,000	276	292	5.6	238	271	10.7	242	282	10.3	328	257	6.1	252	280	10.0	207	295	10.4	208	283	10.6	234	267	6.4	273	267	5.4	---	---	---	---	---	---	---	---	---	222	282	14.0
5,000	264	288	7.9	200	278	11.6	204	286	11.6	295	263	7.8	224	282	11.7	175	291	12.6	141	290	13.0	197	270	9.0	252	266	6.8	---	---	---	---	---	---	---	---	---	174	282	15.7
6,000	250	286	9.6	163	280	13.5	190	289	12.9	266	266	9.3	183	286	13.4	151	291	14.2	---	---	---	147	272	9.7	238	271	7.8	---	---	---	---	---	---	---	---	---	---	---	---
8,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	173	266	8.7	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 3A.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T., during year 1948. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,636 m.)			Big Spring, Tex. (774 m.)			Bismarck, N. Dak. (505 m.)			Brownsville, Tex. (7 m.)			Caribou, Maine, (191 m.)			Charleston, S. C. (13 m.)			Columbia, Mo. (237 m.)			Grand Junction, Colo. (1,473 m.)			Greensboro, N. C. (275 m.)			Hatteras, N. C. (3 m.)			International Falls, Minn. (358 m.)			Little Rock, Ark. (80 m.)			Miami, Fla. (12 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	366	132	1.0	364	145	2.8	364	67	0.9	365	124	2.4	362	272	1.6	365	151	0.4	366	137	1.0	366	00	0.0	340	239	0.2	359	306	0.3	366	212	0.4	365	110	0.3	361	85	1.5
500										365	133	5.9	356	281	3.9	358	195	2.3	363	168	2.2				337	229	1.5	345	255	1.8	364	230	1.2	365	170	1.5	360	114	3.6
1,000				365	165	4.6	355	277	1.2	365	141	4.9	351	289	5.0	352	233	2.6	360	234	3.0				336	247	3.3	343	261	2.8	363	263	2.8	364	212	2.8	360	115	3.1
1,500				365	193	4.8	352	285	3.5	364	149	3.2	349	288	6.0	352	250	3.6	358	258	4.5	365	188	.1	331	261	4.6	340	266	4.4	358	278	4.0	364	233	4.1	358	118	2.1
2,000	365	257	2.6	364	223	4.5	351	287	4.7	363	171	1.9	342	286	7.0	348	260	4.6	358	268	5.8	365	234	1.8	330	272	5.5	336	269	5.6	357	287	5.1	361	247	5.1	358	146	1.1
2,500	365	262	4.5	360	244	5.1	349	289	6.3	363	208	2.0	338	281	8.0	346	265	5.8	360	273	7.2	365	236	3.0	294	273	6.2	332	272	6.7	355	289	6.2	358	257	6.0	357	199	1.1
3,000	365	265	5.9	357	256	6.0	349	290	7.7	363	235	2.4	336	279	9.3	344	266	6.8	360	276	8.4	365	244	4.3	274	277	6.8	327	272	8.1	351	290	7.5	353	261	7.2	358	230	1.5
4,000	364	267	7.5	353	270	7.5	348	288	9.8	362	253	4.2	314	273	11.8	332	267	8.4	354	280	10.4	364	260	6.1				322	270	9.8	339	288	9.5	347	262	9.9	355	257	2.9
5,000	358	272	9.4	339	273	9.2	342	287	11.1	360	263	5.5	299	272	13.1	319	272	9.9	347	283	14.9	358	268	8.2				290	273	10.9	327	288	10.7	335	263	11.9	353	263	4.5
6,000	349	271	11.4	326	271	10.5	333	287	12.7	357	261	7.1	265	271	14.9	303	273	11.1	337	275	14.1	340	270	10.6				280	250	12.4	310	285	12.0	318	260	12.5	344	264	6.2
8,000	288	269	12.6	273	269	11.7	303	279	15.2	346	260	10.6	197	271	16.5	276	272	13.8	307	272	17.5	288	269	12.6				229	276	13.5	254	280	13.3	278	262	13.9	333	269	9.6
10,000	240	278	11.7				252	269	17.6	321	266	12.4																		195	276	15.9	212	267	14.3	314	273	12.5
12,000										272	264	14.2																								287	277	14.8

Altitude (meters) m. s. l.	Nantucket, Mass. (13 m.)			Nashville, Tenn. (180 m.)			New Orleans, La. (6 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (392 m.)			Rapid City, S. Dak. (980 m.)			St. Cloud, Minn. (318 m.)			San Antonio, Tex. (242 m.)			San Juan, P. R. (28 m.)			Santa Maria, Calif. (72 m.)			Sault Ste. Marie, Mich. (221 m.)			Spokane, Wash. (726 m.)			Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	347	270	0.8	362	162	0.4	361	123	0.6	364	281	3.0	357	128	1.9	364	293	1.1	361	SW 226	0.3	366	E 118	2.5	364	101	3.5	365	277	2.1	363	289	0.7						
500	338	274	3.9	360	189	1.4	358	156	1.8	359	288	3.6	344	138	2.6				349	234	.5	366	127	4.3	363	93	7.3	362	335	3.1	362	289	1.5						
1,000	333	285	4.3	355	231	2.7	351	164	1.2	357	290	3.3	335	176	3.6	360	293	1.1	347	261	2.1	365	144	4.3	362	94	7.5	362	344	3.3	358	272	3.4						
1,500	328	282	5.9	349	254	4.0	350	221	.9	356	289	2.9	332	220	3.7	358	284	2.4	344	278	3.9	364	175	2.8	359	91	6.8	362	352	2.8	352	278	4.8						
2,000	328	277	7.3	348	264	5.3	350	247	2.0	355	286	3.0	331	246	4.9	357	289	4.1	344	282	5.4	361	222	2.9	357	90	6.3	362	340	2.7	347	281	6.1						
2,500	326	276	8.8	345	267	6.7	348	253	3.3	355	288	3.8	334	258	6.0	354	291	5.5	343	285	6.9	359	243	3.5	356	89	6.0	361	311	3.6	336	282	7.4						
3,000	318	274	10.7	337	271	8.1	346	256	4.7	356	287	4.8	337	264	7.0	354	292	7.5	345	287	8.1	359	250	4.4	353	89	5.5	360	297	5.3	331	283	8.5						
4,000	304	273	13.4	321	275	10.6	339	261	6.7	351	286	7.1	337	271	9.0	350	289	9.6	340	285	9.8	354	262	6.1	348	84	4.3	356	289	7.6	319	284	11.2						
5,000	286	272	15.7	291	276	12.0	330	266	8.9	337	283	9.1	330	273	10.5	344	285	11.2	329	285	11.4	346	268	7.8	343	73	3.3	348	281	9.6	297	287	12.4						
6,000	255	273	17.3	256	276	12.8	318	268	10.5	323	281	11.1	310	272	12.4	333	282	12.7	313	282	12.9	329	266	8.8	341	50	2.0	335	275	10.6	278	284	14.0						
8,000							297	268	13.7	275	274	14.0	265	274	14.5	316	278	14.8	278	281	15.0	294	269	11.0	333	310	2.6	304	272	13.2	213	281	16.9						
10,000							274	273	15.9	202	272	16.3				291	273	18.2	222	278	17.1	260	267	10.2	329	289	7.5	226	273	14.9									
12,000																257	267	19.2							326	282	12.2												
14,000																									277	291	11.0												
16,000																																							

NOTE.—Resultants prepared from rawins at high altitudes are biased toward lower wind speeds. Values appearing in this table should therefore be used with caution when the number of observations missing is greater than three. See note following Table III in the June 1948 issue of the MONTHLY WEATHER REVIEW.

REPORTS RECEIVED TOO LATE TO BE INCLUDED IN TABLES

TABLE 2A

Altitude (meters) m. s. l.	Billings, Mont. (1,095 m.)			Boise, Idaho (868 m.)			Havre, Mont. (767 m.)			Medford, Oreg. (416 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	362	279	1.7	355	319	1.7	342	260	2.2	353	301	1.3	332	232	1.8	345	219	2.3
500										353	301	1.3	332	218	3.0			
1,000				355	312	1.7	342	257	3.6	351	272	1.1	300	214	3.8	345	220	3.6
1,500	362	269	3.2	355	286	1.9	337	262	5.1	336	234	2.2	258	217	4.0	326	226	4.4
2,000	352	272	4.4	347	272	2.6	324	266	6.3	302	224	3.0	212	214	4.0	305	232	4.7
2,500	334	269	5.8	335	263	3.6	300	268	7.4	266	226	3.0	166	223	3.8	274	235	5.1
3,000	304	271	7.0	319	258	4.6	269	269	8.3	240	246	3.1	146	235	4.3	242	239	6.0
4,000	260	273	9.3	267	255	6.4	191	269	10.7	200	261	4.8				181	252	7.0
5,000	219	278	11.0	233	255	9.0	148	271	12.2	179	258	6.4						
6,000	154	273	12.7	191	260	9.5												

TABLE 3A

Altitude (meters) m. s. l.	Spokane, Wash. (726 m.)			Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed
Surface	360	203	1.5	355	181	1.6
500				343	227	2.8
1,000	358	219	2.8	340	233	3.3
1,500	355	238	3.7	339	236	3.7
2,000	354	247	4.5	341	246	3.9
2,500	347	253	5.1	341	254	4.9
3,000	342	254	6.1	336	260	5.5
4,000	332	262	7.8	322	269	6.7
5,000	313	266	9.5	306	270	7.8
6,000	289	269	10.0	290	266	8.7
8,000	221	266	11.5	225	265	9.1
10,000	160	267	9.8	183	266	9.5

RIVER STAGES AND FLOODS FOR DECEMBER 1948

ELMER R. NELSON

River stages during December were above normal in the Ohio River Basin and along the Atlantic and east Gulf of Mexico drainage areas from Maryland to Louisiana. They were below normal in the northeastern New England States and west of the Mississippi River except in the Trinity and Brazos River Basins in Texas. River stages were below normal in the Missouri River Basin for the first time in 6 months. The greatest positive departure was at Demopolis, Ala., where the Tombigbee River averaged 27.2 feet above normal. The monthly mean stage at Cairo, Ill., 30.7 feet, was the highest since 1931 and was 12.8 feet above the 60-year normal.

The most significant flooding during the month developed in eastern New York and southwestern New England during the latter part of December and the early part of January. The floods were of record-breaking proportions in several streams and considerable damage resulted. The serious flood threat that developed in the Willamette Basin on the 11th–12th was averted by the short duration of the storm and the cooler weather and snow that followed. Heavy damages resulted from the severe flooding along the streams in the eastern portion of the southern States during the latter part of November and the first part of December.

The upper reaches of the Missouri and Mississippi Rivers were frozen over by the 10th with 6 inches of ice on the former at Williston, N. Dak. The Mississippi was closed to navigation at La Crosse, Wis., on this date with 2½ inches of ice recorded. During the last decade of the month the ice on the Missouri was reported 18 inches thick at Bismarck, N. Dak., with floating ice at Kansas City. During this same period, the Mississippi was frozen over to a thickness of 9½ inches at Minneapolis, Minn. In the northeastern rivers and lakes the ice ranged from a few inches to around 6 inches.

Precipitation during the month was mostly above normal along the Atlantic and Pacific Slope drainage areas and along the Canadian border from Lake Michigan to eastern Montana. It was also above normal in an irregular belt from southern Nevada east-northeastward through the Ohio Basin. The greatest precipitation (twice normal) occurred along the southwestern portion of the New England States.

Heavy snow accompanied the storm that developed in the far Southwest during the period of December 3 to 6 as it moved across the Central Rockies into the Great Plains with a record snowfall of 11 inches at Salt Lake City, Utah, on the 7th. The snowfall was exceptionally heavy over the Great Salt Lake Basin during the month and increased considerably the water supply outlook for this area. Heavy snows during the second week increased depths considerably in the mountain ranges of the far west and brought snow depths to above normal in the northern Rockies. The snow pack in the Columbia Basin was well above normal on the 31st and considerably above in the Cascade Mountains of Oregon and Washington. Heavy snow in the California mountains during the third week was favorable for irrigation purposes. During this period, the snow cover advanced eastward to the Atlantic coast for the first time during the season. It reached its farthest southern limits during the last decade of the month when it reached a line extending southwestward from Atlantic City, N. J., to northeastern Georgia, west-northwestward to Dodge City, Kans., thence southwestward to the southwestern corner of New Mexico. The snow cover was thin and spotty east of the 95th meridian and receded to north of the 42d parallel by the 31st.

Atlantic Slope drainage.—Steady moderate rain during the last 3 days of the month brought the total precipitation in Maine almost up to normal and caused the Shepard River, a tributary of the Saco, to overflow a section of the State highway near Fryeburg, Maine, to a depth of 2 feet for an 8-hour period on the 31st. Ice jams formed above Hiram, Maine, on the Saco and above Skowhegan, Maine, on the Kennebec. No damage resulted.

Rapid rises occurred on the Pemigewassett and tributaries in New Hampshire. Crests varied from just below to just above bank-full stage as a result of the 3-day rainstorm. The rainfall amounts were the heaviest in the headwaters and ranged up to 4 inches from the 29th–31st. The crest at Plymouth, N. H., was increased slightly by an ice jam which formed below that point. Overflows were minor and were confined mostly to meadow lands adjacent to the banks. No damage was reported.

Heavy to excessive precipitation, varying from 5 to 12 inches over western Connecticut, western Massachusetts, southern Vermont, and eastern New York for two or more days during the period between December 29 and January 1 caused severe floods in that area. Snow melt had little effect on the resulting peaks as the snow cover was very light (3 to 4 inches). Rapid run-off occurred during the early stages of the flood while the ground was frozen. The excessive rainfall during the early morning hours of the 31st had the greatest effect on the final peaks which attained record or near record levels on the upper reaches of many streams. The total precipitation was greater during the 1938 hurricane, but it was not as intense since it was extended over a longer period. The heavy precipitation over the western reaches of the Connecticut River caused all the western tributaries from the West River southward to crest at or near record levels and produced a sharp rise in the Connecticut itself. The stage of 25.52 feet reached at Hartford, Conn., was the highest winter flood on record, although crests of 26 feet or more have occurred at Hartford at other seasons of the year 12 times during the past 100 years. The crests on the Connecticut were well below the three great floods of November 1927, March 1936, and September 1938.

The upper reaches of the Farmington River exceeded the crests of March 1936 but did not exceed the record heights of September 1938. The lower sections peaked at levels just about equal to those of March 1936. The upper Housatonic River broke all previous records, cresting at Falls Village, Conn., more than 2 feet higher than the September 1938 flood. The entire drainage area above this point received over 8 inches of rain. The Naugatuck River attained slightly higher levels than in 1938 in its upper reaches, and equalled the 1938 flood in its lower reaches. The Hudson River at Albany, N. Y., crested at a slightly lower level than during the 1936 flood. It reached flood stage during the night of December 30–31, rising 10.1 feet during the 24-hour period from a stage of 1.7 feet. Rainfall averaged 6.25 inches over the upper Hudson Valley, 4.75 inches over the Mohawk Basin, and 8.63 inches over the Hoosic River Basin. The rainfall at Albany (5.80 inches) was the heaviest for any one storm during this time of the year in more than 100 years.

Damage to both rural and urban property was extensive with damage for the entire area estimated in the millions of dollars. Several bridges were washed out. Much farm land was inundated and roads were undermined and blocked by landslides. Hundreds of families

in low areas of Pittsfield and Great Barrington, Mass., and in Torrington, Waterbury, Farmington, and Unionville, Conn., had to be evacuated. Disruption of normal pursuits was extensive owing to flooding of homes, industrial plants, water supplies, and transportation. Four lives were lost in the flood, one in the Hartford, Conn., area and three in Berkshire County, Mass.

A comparison of the present flood crests with the maximum previously recorded is given in Table 1.

TABLE 1.—*Comparative flood crests in southwestern New England and eastern New York*

River and station	Current flood		Previous maximum of record	
	Crest	Date	Crest	Date
West:				
Jamaica, Vt.	14.9	Dec. 31	10.5	Apr. 1947
Newfane, Vt.	19.5	...do...	22.8	Sept. 1938
Deerfield:				
Charlemont, Mass.	17.7	...do...	20.2	do.
			15.7	July 1915
West Deerfield, Mass.	15.4	...do...	9.6	Apr. 194
Westfield:				
West Chesterfield, Mass.	12.0	...do...	17.8	Mar. 1948
Westfield, Mass.	22.0	...do...	29.4	Sept. 1938
			27.2	Mar. 1936
Farmington:				
Riverton, Conn.	14.0	...do...	17.95	Sept. 1938
			13.4	Mar. 1936
Rainbow, Conn.	13.4	Jan. 1	13.7	Sept. 1938
Connecticut:				
North Walpole, N. H.	24.5	Dec. 31	25.2	Apr. 1947
Montague City, Mass.	37.3	Jan. 1	49.2	Mar. 1936
Hartford, Conn.	25.5	Jan. 2	37.6	do.
Housatonic:				
Great Barrington, Mass.	12.1	Jan. 1	11.7	Sept. 1938
			10.6	Mar. 1936
Falls Village, Conn.	22.9	...do...	20.7	Sept. 1938
			17.4	Mar. 1936
Gaylordsville, Conn.	14.8	...do...	14.5	Sept. 1938
Stevenson, Conn.	19.9	...do...	23.5	Mar. 1936
			21.5	Sept. 1938
Naugatuck:				
Thomaston, Conn.	12.0	Dec. 31	11.9	do.
			9.6	Jan. 1938
Naugatuck, Conn.	12.4	...do...	14.0	Nov. 1927
			12.4	Sept. 1938
Hudson: Albany, N. Y.	17.5	Jan. 1	21.5	Mar. 1913
			18.7	Mar. 1936

Moderate precipitation accompanied by some snow melt on the 29th and 30th caused the Lehigh River to crest 1 foot above bank-full stage at Lehighton, Pa., at 8 p. m. on the 30th. No damage was reported.

Heavy rains over the Schuylkill and Delaware River Basins on the 29th and 30th, caused flood conditions in the Schuylkill on the 30th and in the Delaware on the 31st. The average rainfall along the Schuylkill was 2.89 inches and along the Delaware 3.34 inches. The snow cover over the area ranged from 2 to 5 inches. Considerable overflow occurred along the Perkiomen Creek, especially between Graterford and Collegeville, Pa., but damage was confined to flooded basements in houses near the creek and flooded roads. Only light monetary damage was reported along the Schuylkill.

Moderate rains on the 29th–30th caused light to moderate flooding in the Susquehanna River Basin in New York and minor flooding along the Chenango River in New York and the headwaters of the Juniata River in Pennsylvania. Crests in the lower Susquehanna Basin were 4 to 8 feet below flood stage. No serious damages were reported.

Heavy rains over the Rappahannock River Basin (1.95 inches) on the night of the 3d caused light flooding on the Rapidan River at Rapidan, Va., and on the Rappahannock at Remington on the 4th, and resulted in near bank-full stage at Fredericksburg, Va. (16.1 feet). Some flooding occurred on the Monocacy River in Maryland on the 31st as a result of heavy rain (1.6 inches) on the 29th–30th.

Heavy rain on the 3d–4th caused a major flood in the James River Basin in Virginia from the 3d to the 7th. The rainfall ranged from 5.19 inches at Bremo Bluff to 1.21 inches at Richmond, and 1.45 inches at Williamsville in the upper reaches. The run-off was high as the entire basin was saturated from the minor flood of November 28th–30th with initial stages 2 to 5.5 feet above normal. Losses were confined mostly to crops in the field. A minor flood occurred on December 31–January 1 which affected only the reach below Bremo Bluff. The rainfall over the basin averaged about 2 inches.

Double crests with widespread flooding occurred on the rivers in eastern North Carolina, as a result of the heavy rains on November 28–29 and December 3–4. The rainfall during the first storm averaged 2 inches. During the latter over an inch was reported over the Cape Fear, Neuse, and Tar Rivers and approximately 3 inches over the headwaters of the Roanoke. Major damage was restricted to highways and bridges in the vicinity of Kinston, N. C., and some loss was incurred by logging interests.

Damage estimates for the floods in the Santee River system in South Carolina during the period November 28–December 3 were the greatest in 3 years. Most of the property damage occurred in the vicinity of Camden, where the rainfall was excessive during the night of November 28. Small streams in that locality did considerable damage, besides the damage along the main stream of the Wateree River. The Seaboard Railroad trestle across this river near Camden was washed out of line. The loss over the entire State was around $1,000,000. Light flooding occurred on the Broad River during the last 2 days of the month but no damage was reported.

In Georgia the very heavy rains late in November were supplemented by light to moderate falls during the first 7 days of December and by heavy rain (2 to 5 inches) on the 8th day in the southwestern and south-central counties. No rainfall of much importance occurred after this until the 31st when general rains of 1 to 2 inches or more occurred. All stations along the Ocmulgee, Oconee, and Altamaha Rivers exceeded flood stage during the early days of December as a result of heavy rains in November. Some upper stream stations reached crest stages on the last 2 days of November, but most stations had their crests during the first week of December. This flood was one of the biggest to affect this area during periods of record, and numerous stations had crest stages that were very near record height. Flood crests ranged from slightly less than 5 to as much as 10 feet above flood stage and caused a great deal of damage and inconvenience. The greatest loss occurred along the Ocmulgee River in the Macon area.

East Gulf of Mexico drainage.—Heavy rains (2.30 inches) over the Choctawhatchee River Basin on the 7th–8th caused slight flooding in the lower Choctawhatchee River at Caryville, Fla., on the 11th.

The flood damages during the period November 27 through December 12 in Georgia were heaviest along the Chattahoochee River between Atlanta and West Point. A large number of families were forced to leave their homes in low-lying residential areas at both Atlanta and West Point; much damage was done to building foundations and furnishings; many acres were inundated, causing losses to crops, roads, and bridges; and other miscellaneous damage was reported. Losses below Columbus were mainly to livestock, crops, and roadways. Damages along the Flint River were fairly well distributed as far south as Newton, below which little damage occurred. About 30 families had to leave their homes in the Albany

area. In the Newton area a large number of people were moved to higher ground, as high waters practically surrounded the town. Along the Apalachicola River the greatest loss resulted from suspension of business and loss of wages.

The extreme lower Tombigbee in Alabama remained in flood during the entire month at locks 1 and 3. A slight rise beginning on the 19th brought flood stages at locks 2 and 4.

The floodwaters in Mississippi gradually receded after the 8th of December from the near record stages reached during the latter part of November and the early part of December. A brief rise began on the 16th over the headwaters and intermediate reaches of the Pearl River, prolonging the flood in the Jackson reach. No unusual damages resulted from the flooding, but several families were evacuated from the lower areas of Jackson, Miss.

Ohio Basin.—General rains which began in the upper Ohio Valley on the evening of the 14th and continued to the 16th caused flooding on the Tygart, West Fork, and Little Kanawha Rivers in West Virginia; on the Hocking River in Ohio, and on the Monongahela River in Pennsylvania. The rainfall over the Tygart and West Fork Rivers averaged 3.25 inches and over the Hocking, Little Kanawha and the upper reaches of the Monongahela Basin around 4 inches. Navigation was interrupted along the entire length of the Monongahela River.

Flood stages were reached on the Scioto River in Ohio as a result of the heavy rain (1.25 to 2.50 inches) over the basin on the 14th–16th. The worst effect of the flooding was the temporary closing of highways in low places.

Rainfall over the Green River Valley, in Kentucky on the 15th–16th averaged slightly over 3 inches and caused moderate flooding from Brownsville to Rumsey, Ky.

Heavy rain ranging from 1 to 3 inches on the 15th–16th caused light flooding on the Wabash and White Rivers in Indiana. Additional heavy rain on the 29th, ranging from 1 to 2 inches, caused another rise with more flooding than before as the ground was saturated and frozen. However, the damage was light.

The First Creek at Knoxville, Tenn., rose to above bank-full stage for a few hours on the 24th–25th as a result of 2.40 inches of rain in approximately 24 hours.

Flood stage was exceeded on the Ohio River below Pittsburgh, Pa., in the vicinity of Dam 7 at Midland, Pa. at Point Pleasant, W. Va., and from Lock No. 47 at Newburgh, Ind., to Lock No. 50 at Fords Ferry, Ky., as a result of the heavy rain from the 14th to the 16th. The rainfall over the Ohio Valley averaged 1.75 inches. River navigation locks were lowered along the Ohio. One person lost his life during the flood by falling from a barge near Point Pleasant, W. Va. Some loss occurred to crops in the Evansville area.

Columbia Basin. Heavy rain on the 11th–12th (1.75 inches) over the Willamette Valley caused moderate flooding in the streams in the basin. A serious flood threat already existed as a combination of warm rain and wind caused a substantial melting of snow at low and intermediate elevations. It was also the second storm in the valley during the 11-day period in December with average precipitation of 1.50 inches. The threat of serious flooding was averted by the short duration of the storm which was followed by more snow at intermediate and higher elevations and cooler weather. Considerable damage resulted to agricultural land, highways, bridges, fences, crops, and pastures. The major portion of the damages occurred in the Eugene-Harrisburg section.

FLOOD STAGE REPORT FOR DECEMBER 1948

[All dates in December unless otherwise specified]

River and station	Flood stage	Above flood stage—dates		Crest[1]	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Baker: Rumney, N. H.	7	31	Jan. 1	7.3	31
Pemigewassett: Plymouth, N. H.	11	31	Jan. 1	13.0	31
Connecticut:					
Walpole, N. H.	30	31	31	31.0	31
Montague City, Mass.	30	31	Jan. 1	37.3	31
Holyoke, Mass.	9	31	Jan. 2	11.6	Jan. 1
Hartford, Conn.	16	31	Jan. 4	25.5	Jan. 2
Hudson:					
Troy, N. Y.:					
Upper Gage	24	31	Jan. 1	27.6	31
Lower Gage	19	31	Jan. 1	23.8	31
Albany, N. Y.	11	31	Jan. 2	17.5	Jan. 1
Lehigh: Lehighton, Pa.	9	30	30	10.0	30
Perkiomen Creek: Graterford, Pa.	8			12.8	30
Schuylkill:					
Reading, Pa.	13	30	31	14.8	31
Philadelphia, Pa.	11.5	30	(2)	12.6	30
Delaware: Easton, Pa.	22	31	Jan. 1	24.1	31
Chenango:					
Sherburne, N. Y.	8	30	30	8.4	30
Greene, N. Y.	8	31	31	9.3	31
Binghamton, N. Y.	16	31	31	16.1	31
Little Juniata: Spruce Creek, Pa.	7	30	31	7.3	30
Susquehanna:					
Oneonta, N. Y.	13	30	Jan. 1	15.8	31
Bainbridge, N. Y.	13	31	Jan. 1	15.2	31
Vestal, N. Y.	14	30	Jan. 2	18.5	31
Monocacy: Frederick, Md.	15	31	31	17.1	31
Rapidan: Rapidan, Va.	14	4	4	15.5	4
Rappahannock: Remington, Va.	15	4	4	15.5	4
James:					
Buchanan, Va.	17	4	4	17.0	4
Scottsville, Va.	20	3	5	23.0	5
Bremo Bluff, Va.	19	3	6	30.7	4
Columbia, Va.	18	3	6	33.5	5
		31	31	19.9	31
State Farm, Va.	12	4	7	25.0	5
		31	31	12.4	31
Richmond, Va.	8	4	7	21.6	6
		31	Jan. 1	8.4	31
Roanoke:					
Alta Vista, Va.	10	Nov. 29	Nov. 30	23.0	Nov. 29
		16	16	10.2	16
		30	(2)		
Randolph, Va.	21	Nov. 29	1	24.0	Nov. 29
		5	7	28.7	6
		31	(2)		
Weldon, N. C.	31	Nov. 30	9	41.5	8
Scotland Neck, N. C.	28	Nov. 30	11	33.2	9
Williamston, N. C.	10	Nov. 27	27	12.8	11
Tar:					
Rocky Mount, N. C.	9	Nov. 30	3	9.5	3
Tarboro, N. C.	18	2	9	22.4	5
Neuse:					
Neuse, N. C.	14	Nov. 29	7	18.3	2
Smithfield, N. C.	13	Nov. 29	9	18.9	5
		31	(2)		
Goldsboro, N. C.	14	Nov. 29	14	20.4	9
Kinston, N. C.	14	Nov. 30	17	17.8	11
Cape Fear:					
Fayetteville, N. C.	35	Nov. 30	2	44.7	Nov. 30
Lock No. 2, Elizabethtown, N. C.	20	Nov. 29	8	31.7	2
Waccamaw: Conway, S. C.	7	5	22	8.3	11
Pee Dee:					
Cheraw, S. C.	30	30	Jan. 1	35.0	Jan. 1
Pee Dee, S. C.	19	Nov. 26	14	24.2	5
Saluda: Pelzer, S. C.	6	Nov. 27	1	12.3	Nov. 29
		3	3	6.0	3
		5	5	6.0	5
Broad: Blairs, S. C.	14	30	31	17.2	31
Edisto:					
Orangeburg, S. C.	8	9	14	9.0	10
		21	21	8.0	21
Givhans Ferry, S. C.	10	Nov. 29	(2)	14.6	3
Savannah:					
Augusta, Ga.	32	Nov. 29	1	36.2	Nov. 30
Butler Creek, Ga.	21	Nov. 28	3	26.4	Nov. 30
Ogeechee:					
Midville, Ga.	6	Nov. 30	5	7.8	2,3
		11	12	6.2	11
Dover, Ga.	7	Nov. 30		9.8	6
Ocmulgee:					
Macon, Ga.	18	Nov. 27	2	23.0	Nov. 28–29
Hawkinsville, Ga.	25	1	6	34.2	2,3
Abbeville, Ga.	11	1	14	19.6	4
Lumber City, Ga.	15			22.6	9
Oconee:					
Milledgeville, Ga.	20	Nov. 27	4	38.5	Nov. 29
		30	31	22.2	31
Dublin, Ga.	21	1	8	30.4	3
Mount Vernon, Ga.	16	2	14	22.8	3
Altamaha:					
Charlotte, Ga.	12	2	31	26.2	9
Doctortown, Ga.	10	9	15	10.9	12

See footnotes at end of table.

FLOOD STAGE REPORT FOR DECEMBER 1948—Continued

River and station	Flood stage	Above flood stages—dates		Crest [1]	
		From—	To—	Stage	Date
EAST GULF OF MEXICO DRAINAGE					
Chattahoochee:					
West Point, Ga.	19	Nov. 27	2	22.4	Nov. 29
Columbus, Ga.	34	Nov. 27	1	42.0	Nov. 28
Eufaula, Ala.	40	Nov. 28	4	55.1	Nov. 30
Columbia, Ala.	42	Nov. 29	4	49.4	1
Flint:					
Montezuma, Ga.	20	Nov. 30	3	25.0	1
Albany, Ga.	20	1	9	31.5	4
Bainbridge, Ga.	25	4	12	31.0	7
Apalachicola:					
Chattahoochee, Fla.	20	1	10	25.4	5
Blountstown, Fla.	15	1	31	23.5	6
Choctawhatchie: Caryville, Fla.	12	11	11	12.1	11
Tombigbee:					
Lock No. 4, Demopolis, Ala.	39	19	24	44.8	21
Lock No. 3.	33	Nov. 21	[2]	58.2	8
				47.2	22
Lock No. 2.	46	19	25	49.0	22
Lock No. 1.	31	Nov. 24	Jan. 1	40.1	12–13
Pascagoula: Merrill, Miss.	22	Nov. 25	11	25.7	Nov. 28
Pearl:					
Edinburg, Miss.	20	Nov. 27	Jan. 7	26.0	1
Jackson, Miss.	18	Nov. 20	[2]	32.9	6
Monticello, Miss.	15	Nov. 26	18	22.9	2
Columbia, Miss.	17	Nov. 17	19	21.2	3
Pearl River, La.	12	Nov. 24	[2]	16.7	Nov. 30
MISSISSIPPI SYSTEM					
Ohio Basin					
Buckhannon: Hall, W. Va.	11	16	16	11.0	16
Tygart:					
Daily, W. Va.	9	15	17	10.4	16
Belington, W. Va.	14	16	17	15.0	16
Philippi, W. Va.	17	16	17	19.8	16
West Fork:					
Weston, W. Va.	17	15	17	20.0	16
Clarksburg, W. Va.	7	16	17	8.8	16
Monongahela:					
Lock No. 8 (Lower gage), Point Marion, Pa.	27	16	16	29.7	16
Lock No. 6 (Lower gage), Rices Landing, Pa.	27	15	17	33.6	16
Lock No. 5 (Lower gage), Brownsville, Pa.	29	16	17	37.4	16
Lock No. 4 (Lower gage), Charleroi, Pa.	28	16	17	33.1	16
Lock No. 3 (Lower gage), Elizabeth, Pa.	26	16	17	32.3	16
Little Kanawha:					
Glenville, W. Va.	23	15	17	28.9	16
Creston, W. Va.	20	15	17	24.6	16
Hocking: Athens, Ohio.	17	16	17	18.2	17
Scioto:					
La Rue, Ohio.	11	16	17	12.6	16
Prospect, Ohio.	10	17	18	11.2	18
Circleville, Ohio.	14	17	17	14.0	17
Piketon, Ohio.	15	16	18	19.6	16
Middle Fork: Midvale, W. Va.	11	16	16	11.0	16
Barren: Bowling Green, Ky.	28	17	19	31.5	18
Green:					
Lock No. 6, Brownsville, Ky.	28	17	19	32.4	18
Lock No. 4, Woodbury, Ky.	33	16	22	41.6	19
Lock No. 2, Rumsey, Ky.	34	19	29	38.8	24

FLOOD STAGE REPORT FOR DECEMBER 1948—Continued

River and station	Flood stage	Above flood stages—dates		Crest [1]	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM—continued					
West Fork:					
Anderson, Ind.	10	16	17	11.0	1
		30	30	10.4	3
Elliston, Ind.	18	31	Jan. 2	19.9	Jan.
Edwardsport, Ind.	12	16	21	15.4	1
		30	[2]	17.8	Jan.
East Fork: Seymour, Ind.	14	16	16	14.2	16
White: Petersburg, Ind.	16	17	22	16.9	18–19
Wabash:					
Wabash, Ind.	12	16	17	12.8	16
		29	30	14.0	29
		18	18	11.0	18
La Fayette, Ind.	11	29	Jan. 1	15.3	31
Covington, Ind.	16	31	Jan. 2	17.6	Jan. 1
First Creek: Mineral Springs, Tenn.	5	24	25	5.7	25
Ohio:					
Dam No. 7, Midland, Pa.	30	17	17	31.2	17
Point Pleasant, W. Va.	40	18	18	40.0	18
Dam No. 47, Newburgh, Ind.	38	21	25	40.3	24
Dam No. 48, near Henderson, Ky.	38	23	25	38.6	24
Mount Vernon, Ind.	35	23	26	35.8	25
Shawneetown, Ill.	33	22	28	36.0	25
Dam No. 50, Fords Ferry, Ky.	34	21	28	38.0	25–26
Lower Mississippi Basin					
Tallahatchie: Swan Lake, Miss.	26	Nov. 23	13	28.6	1, 2
PACIFIC SLOPE DRAINAGE					
Columbia Basin					
Coast Fork: Saginaw, Oreg.	9	12	12	9.6	12
McKenzie:					
Leaburg, Oreg.	12	11	13	19.4	12
Hendricks Bridge, Oreg.	13	12	12	13.1	12
Coburg Bridge, Oreg.	11	12	12	14.5	12
Calapooya: Holley, Oreg.	10.5	12	12	11.1	12
Santiam: Jefferson, Oreg.	13	8	8	13.4	
		11	14	19.2	12
Yamhill: Whiteson, Oreg.	38	11	12	41.6	12
Tualatin: Dilley, Oreg.	12	2	15	12.7	12
Willamette:					
Eugene, Oreg.	12	12	12	14.5	12
Harrisburg, Oreg.	12	11	15	17.8	13
Corvallis, Oreg.	20	13	14	24.1	13
Albany, Oreg.	20	13	15	25.8	13–14
Salem, Oreg.	20	13	15	21.8	14
Oregon City, Oreg.	12	13	16	14.5	15
Chehalis Basin					
Satsop: Satsop, Wash.	29	2	2	32.4	2
Chehalis: Grand Mound, Wash.	12	2	4	14.0	3
		10	14	14.4	11
Puget Sound					
Snoqualmie: Tolt, Wash.	50	2	2	50.3	2
Snohomish: Snohomish, Wash.	20	2	2	20.7	2

[1] Provisional.

[2] Continued at end of month.

CLIMATOLOGICAL DATA FOR DECEMBER 1948

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January 1943, p. 15]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitations; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	51.2	+3.5	Eufaula	82	17	Valley Head	+12	26	4.53	−0.75	Elba	9.09	Peterman	2.33
Arizona	42.6	+.3	Mohawk	85	30	Fort Valley	−12	24	1.95	+.66	Workman Creek 1	7.74	Ehrenburg	.09
Arkansas	44.3	+1.5	2 stations	83	1 13	Batesville	+8	26	4.03	−.20	Paragould	8.18	Dumas	1.41
California	40.7	−4.9	do	85	9	Boca	−23	24	3.75	+.09	Gasquet R. S	18.70	Greenland Ranch	.00
Colorado	26.0	+.1	Eversoll Ranch	80	13	Kremmling	−39	25	1.12	+.24	Wolf Creek Pass 4 W	6.06	3 stations	T
Florida	65.8	+5.8	4 stations	89	1 10	Marianna Ind. School	+25	31	2.90	+.13	Vernon	8.64	2 stations	.01
Georgia	51.8	+4.0	Waycross	83	16	Blairsville Exp. Sta	+10	26	5.23	+.92	Blakely	9.13	Quitman	2.64
Idaho	19.7	−6.8	Deer Flat Dam	56	3	2 stations	−36	23	2.86	+.78	Roland (West Portal)	10.98	Chilly 4 SE (Barton F.)	.45
Illinois	34.0	+2.9	East St. Louis	78	15	Carlinville 4 E	−12	26	2.70	+.59	Cairo W B City	5.03	Quincy CAA	.55
Indiana	34.8	+2.6	Bloomington, Ind. U	73	15	2 stations	−8	26	3.50	+.78	Salem	5.34	W. Lafayette Purdue U.	2.47
Iowa	25.5	+.9	6 stations	64	4	Atlantic (AP)	−21	25	1.63	+.53	Oskaloosa	3.63	Mapleton 5 NW	.39
Kansas	34.4	+1.3	5 stations	75	1 3	Horton	−15	26	.42	−.49	Stillwell	1.53	4 stations	T
Kentucky	40.3	+2.5	Corbin	74	14	Farmers	−6	26	4.34	+.57	Mayfield 2 S	8.39	Anchorage	2.33
Louisiana	55.7	+3.2	Jennings	87	24	Plain Dealing	19	27	4.42	−.90	Weyanoke	10.81	Colfax	1.10
Maryland-Delaware	38.2	+2.9	Great Falls, Md	71	13	Oakland, Md	−9	27	5.40	+2.35	Millington, Md	7.57	Cumberland, Md	3.85
Michigan	27.6	+2.0	Ann Arbor, U. of Mich	62	5	Kenton U. S. Forest	−22	26	1.98	−.06	Bloomingdale	3.60	Kenton U. S. Forest	.44
Minnesota	14.7	−1.1	Albert Lea	58	3	Bemidji Airport	−40	25	.92	+.16	Grand Marais Coast Guard	2.49	Redwood Falls	T
Mississippi	51.7	+3.4	2 stations	83	15	Duck Hill	+17	31	4.41	−.86	Woodville	8.70	Port Gibson	1.82
Missouri	37.0	+2.8	Ozark Beach	81	14	Bethany	−26	26	2.17	0	Caruthersville	6.47	Lamar	.71
Montana	14.5	−8.8	Hardin	62	2	West Yellowstone	−39	23	.89	−.06	Haugan	5.33	Dunkirk	.06
Nebraska	25.7	−1.5	Valentine W B	70	3	Tecumseh	−21	26	.90	+.22	Pawnee City 6 SE	2.32	Curtis	.20
Nevada	27.9	−2.8	2 stations	74	1 3	Fish Creek Ranch	−28	24	1.01	+.03	Jarbidge	4.11	Thorne	T
New England	29.3	+2.9	4 stations	60	1 6	Lemington, 1 W, Vt	−26	25	3.73	+.40	Torrington 1, Conn	10.91	Middleton, Mass	.96
New Jersey	35.4	+1.8	2 stations	68	1 5	Runyon	−16	27	6.43	+2.90	Hammonton	8.32	Deepwater	4.37
New Mexico	37.8	+3.5	do	79	1 5	Selsor Ranch	−18	29	.70	−.01	Cloudcroft No. 2	5.75	21 stations	0
New York	29.2	+2.5	3 stations	60	1 7	Speculator	−23	25	4.17	+1.22	West Shoken	10.37	Stafford	1.01
North Carolina	46.1	+3.5	do	78	1 13	Celo	−5	26	4.89	+1.08	Hatteras WB City	8.91	Swannanoa	1.97
North Dakota	10.8	−2.5	Mott RR Station	59	2	Bottineau State Park	−35	10	.66	+.18	Rugby 1 N	2.09	2 stations	.06
Ohio	34.9	+3.2	3 stations	67	13	Millport 2 NW	−3	26	3.10	+.37	Chilo Dam 3, 4	4.90	Put-in-Bay Stone Lab	1.56
Oklahoma	42.7	+2.6	6 stations	85	1 13	Kenton	+5	24	1.02	−.69	Stilwell	5.17	11 stations	0
Oregon	28.4	−5.2	Modoc Orchard	68	12	Austin 3 S	−26	23	6.08	+2.12	Valsetz	29.88	Durkee	.63
Pennsylvania	32.6	+1.4	Huntingdon	69	14	Kane	−16	26	4.25	+1.18	George School	7.17	Warren	1.79
South Carolina	49.9	+3.1	Orangeburg, 2 Mi SE	83	17	Caesar's Head	+9	26	4.46	+.84	Caesar's Head	7.02	Charleston WB City	3.32
South Dakota	20.2	−1.9	2 stations	73	3	McLaughlin	−18	10	.29	−.22	2 stations	1.08	Sisseton	T
Tennessee	43.4	+2.6	4 stations	75	1 13	Bristol WB Airport	+5	26	6.01	+1.49	Dover 1 Mi NW	9.27	Memphis WB Airport	2.70
Texas	52.1	+3.2	McCook	95	24	Dalhart Exp. Station	+8	25	.69	−1.63	Palestine WB	4.70	37 stations	0
Utah	25.4	−2.4	Bluff	69	4	2 stations	−30	1 25	1.77	+.71	Alta	9.53	Fruita	.45
Virginia	40.5	+2.4	2 stations	79	6	Burkes Garden	−10	26	5.29	+2.22	Rockfish	8.76	Speedwell	2.54
Washington	27.2	−7.0	Moses Lake Devel. F	59	1	Chewelah 2 S	−27	24	6.02	+.58	Wind River	22.92	Quincy 4 S	.94
West Virginia	37.7	+3.1	2 stations	71	1 6	Union	−12	27	4.97	+1.71	Pickens No. 1	8.72	Wheeling, Ohio County, A. P.	2.96
Wisconsin	21.7	+1.1	do	60	4	Hatfield Power Co. Dam	−25	26	1.41	+.12	Racine	3.64	Owen County Asylum	.34
Wyoming	18.7	−3.6	Midwest	69	3	Bondurant	−44	25	.99	+.28	Moose 3 NW	5.45	Powell	.06
Alaska (Nov.)	8.9	−5.2	Cape Decision	54	14	Allakaket	−58	1 25	3.16	+.41	Little Port Walter	34.11	2 stations	.12
Hawaii	68.9	−.9	Mahukona	90	5	Haleakala Ranger Sta	+35	25	11.25	+3.43	Waiakamoi Gulch	64.73	3 stations	.00
Puerto Rico	74.2	−.1	Dos Bocas	96	1	Cidra	+49	31	4.40	+.07	St. Just (near Rio Piedras, P. R.)	18.00	Santa Isabel	.54

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR DECEMBER 1948

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Temperature of the air: Extremes: Highest	Date	Lowest	Date	Greatest daily range	Total heating degree days	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
NEW ENGLAND	Ft.	Ft.	Ft.	Mb.	Mb.	Mb.	°F.	°F.	°F.	°F.	°F.		°F.		°F.		°F.	%	In.	In.	In.			In.	In.	m. p.h.					0-3	4-7	8-10	0-10	%
									30.5	+4.0								79	3.55	−.2																6.7	
Caribou [1]	628	5	33	991.5	1,015.6	.....	27	12	19.9	+6.7	42	6	−5	25	40	1,395	16	88	2.92	+.4	.77	12	0	16.1	8.0	....	nw.	..	.....	..	4	8	19	7.5	....
Eastport	75	67	82	1,012.5	1,015.6	+.7	36	25	30.8	+4.5	52	6	4	25	27	1,060	23	72	3.68	−.1	1.24	9	1	1.9	.0	12.4	w.	48	e.	31	10	9	12	6.0	56
Portland, Me. [2]	103	6	43	1,012.2	1,016.3	−.6	39	21	29.8	+4.8	53	8	−2	27	34	1,090	22	81	3.83	−.1	1.36	9	1	4.0	.0	8.9	nw.	40	e.	31	11	9	11	5.3	58
Concord [3]	289	5	45	1,005.8	1,016.9	+.3	39	19	29.0	+5.0	54	7	−6	27	40	1,119	21	79	2.11	−1.0	.87	9	0	2.5	.0	7.0	nw.	37	e.	31	9	9	13	5.9	37
Mt. Washington	6,274	5	37	797.7	1,017.8	.....	18	6	11.8	+3.2	41	5	−19	26	22	1,649	8	86	5.52	−1.6	1.42	17	0	23.1	5.0	41.0	nw.	..	.....	..	4	6	21	7.6	29
Burlington [3]	403	6	51	1,001.4	1,016.6	−1.0	36	21	28.6	+4.2	54	5	−8	32	30	1,126	22	80	2.53	+.6	1.40	11	0	3.9	.0	9.7	s.	29	s.	29	1	10	20	8.6	20
Boston [3]	124	33	62	1,012.3	1,017.0	+.1	43	30	36.3	+3.8	58	7	7	26	26	892	26	68	1.25	−2.2	.59	9	0	5.5	.0	11.9	nw.	38	e.	31	10	6	15	6.3	38
Nantucket [3]	12	4	34	1,016.3	1,016.6	.0	44	32	37.8	+2.0	56	8	10	27	26	839	33	79	2.46	−1.3	1.19	12	1	3.1	.0	14.4	nw.	42	e.	19	7	5	19	6.9	35
Block Island	26	11	46	1,015.6	1,016.6	−.3	44	34	39.2	+3.2	57	6	11	26	23	801	34	82	2.59	−1.2	1.02	12	0	2.2	.0	18.7	nw.	46	ne.	19	8	9	14	6.4	45
Providence [3]	159	65	60	1,010.8	1,016.9	−.7	44	29	36.6	+5.0	60	7	7	27	33	884	26	74	2.30	−1.1	.93	14	0	13.4	.0	8.4	nw.	37	se.	31	10	6	15	6.2	53
Hartford [3]	159	5	44	1,011.5	1,017.6	−.7	42	23	32.2	+2.4	58	30	−2	27	35	1,019	26	80	5.50	+1.5	2.30	14	0	13.2	T	8.0	n.	36	se.	31	6	7	18	6.7	42
New Haven [3]	107	5	39	1,013.2	1,017.3	−1.0	42	26	34.0	+3.1	56	13	−3	27	35	965	26	76	7.88	+4.2	4.25	12	0	19.3	T	7.0	w.	25	e.	31	6	8	17	6.6	44
MIDDLE ATLANTIC									38.0	+2.8								76	5.27	+2.0														6.9	
Albany [3]	97	6	40	1,013.5	1,017.3	−1.0	37	21	29.2	+3.7	51	6	−6	27	32	1,111	23	81	6.05	+3.4	4.02	12	0	3.1	1.0	8.7	w.	34	nw.	6	5	5	21	7.4	35
Binghamton [4]	871	57	79	985.1	1,017.6	−.7	38	23	30.6	+2.4	57	5	0	27	31	1,068	22	80	4.36	+2.0	1.23	15	0	16.7	7.0	5.7	w.	26	se.	5	2	7	22	8.1	43
New York [4]	314	415	454	1,006.4	1,018.3	−.3	45	32	38.8	+3.8	59	13	10	26	29	816	26	64	6.52	+2.9	2.43	11	0	23.5	1.5	15.5	nw.	42	s.	30	8	8	15	6.5	36
Allentown [3]	385	4	58	1,004.4	1,019.0	.....	41	22	31.5	−1.2	61	4	−1	27	31	1,037	25	81	5.06	+1.8	2.15	10	0	10.9	T	....	nw.	..	.....	..	5	9	17	6.9	....
Harrisburg [3]	374	30	49	1,004.7	1,019.0	−1.0	42	27	34.2	+1.5	63	13	5	27	30	951	26	74	3.53	+.5	1.62	10	0	9.9	T	7.4	nw.	34	nw.	31	4	7	20	7.6	53
Philadelphia [4]	114	174	150	1,014.2	1,018.6	−1.0	45	33	39.2	+2.9	61	4	13	26	23	800	30	78	5.63	+2.2	2.15	12	0	7.5	.0	8.1	n.	23	nw.	31	6	13	12	6.4	55
Reading	323	47	306	1,006.4	1,019.0	−.6	44	29	36.1	+1.9	64	4	8	27	27	899	....	..	5.90	+2.3	2.14	12	0	9.6	T	10.3	nw.	35	w.	6	4	14	13	6.7	52
Scranton	805	72	104	988.2	1,018.3	−.7	39	25	32.2	+1.5	56	5	3	27	26	1,012	....	..	4.72	+1.7	1.95	9	0	11.9	3.0	6.2	n.	24	n.	25	2	16	13	6.9	33
Atlantic City	52	37	172	1,016.6	1,018.6	−1.0	47	34	40.8	+4.4	64	13	14	26	24	749	32	74	6.07	+2.1	1.79	10	0	.6	.0	16.7	n.	46	n.	19	5	11	15	7.0	37
Newark [2]	30	5	46	1,016.9	1,018.0	.....	44	28	35.8	+2.4	59	13	3	27	28	907	26	74	5.84	+2.1	2.57	12	0	20.7	1.5	....	nw.	..	.....	..	6	7	18	7.0	....
Trenton	190	89	107	1,011.2	1,018.3	−.7	44	30	37.0	+2.6	59	13	10	27	24	866	....	..	6.08	+2.7	2.67	13	0	12.2	.0	8.8	nw.	27	nw.	31	8	7	16	6.7	41
Baltimore [4]	123	100	215	1,014.2	1,019.0	−.6	47	34	40.8	+3.6	68	13	15	26	23	751	29	70	5.47	+2.1	1.42	7	0	6.8	.0	10.6	n.	39	nw.	31	5	12	14	6.6	43
Washington [4]	112	56	100	1,014.9	1,019.0	−1.0	48	33	40.6	+4.0	70	13	14	26	31	758	31	74	4.93	+1.6	1.30	9	0	4.5	.0	7.5	n.	26	nw.	31	5	7	19	7.4	45
Cape Henry	18	8	54	1,017.6	1,018.3	−.3	53	41	46.8	+3.1	69	29	20	27	26	561	40	78	4.36	+.9	1.68	10	1	T	.0	13.7	n.	49	nw.	25	9	7	15	6.4	50
Lynchburg [3]	686	5	58	993.9	1,019.0	−1.3	50	32	40.9	+3.6	70	14	10	27	30	745	31	76	6.74	+3.5	3.03	12	0	4.1	.0	8.2	s.	26	nw.	31	9	6	16	6.4	46
Norfolk [4]	91	80	125	1,015.6	1,019.0	−1.3	54	40	47.2	+4.1	70	13	19	26	25	551	36	78	4.09	+.8	1.39	13	1	1.2	.0	9.6	n.	34	n.	26	7	7	17	6.5	45
Richmond [4]	144	11	52	1,013.2	1,018.6	−1.7	52	35	43.6	+3.8	70	13	15	26	33	662	33	79	4.29	+1.0	1.44	9	0	.9	.0	7.4	s.	28	s.	29	8	7	16	6.3	50
SOUTH ATLANTIC									50.1	+4.1								78	4.51	+1.1														6.5	
Asheville	2,253	77	92	944.1	1,020.3	−1.4	51	33	42.1	+4.3	72	15	10	26	35	710	34	80	3.92	+.7	1.27	14	0	T	.0	8.5	nw.	26	nw.	31	7	5	19	6.7	51
Charlotte [4]	779	63	86	991.5	1,019.6	−1.1	55	40	47.3	+4.3	73	14	16	26	26	551	38	74	4.58	+.7	1.72	12	1	T	.0	7.0	sw.	21	nw.	31	7	5	19	6.6	51
Greensboro [3]	886	6	56	987.1	1,019.6	−1.1	53	33	42.8	+3.6	72	14	12	27	31	686	34	74	4.01	+.2	1.31	12	0	T	.0	7.6	sw.	26	n.	25	8	5	18	6.5	47
Hatteras	11	5	47	1,018.0	1,018.3	−1.3	57	46	52.0	+1.9	70	7	23	26	22	404	47	82	8.91	+4.7	2.93	15	1	T	.0	13.2	n.	37	n.	25	6	6	19	7.1	53
Raleigh [4]	376	5	71	1,003.1	1,019.3	−1.4	56	38	46.6	+3.6	74	13	14	26	30	568	37	78	4.13	+.6	1.06	12	0	T	.0	7.0	n.	22	nw.	31	2	13	16	7.0	34
Wilmington	72	73	107	1,018.0	1,019.3	−1.4	61	44	52.4	+3.3	76	16	21	26	26	397	45	82	4.95	+2.2	1.44	14	1	T	.0	9.0	n.	29	s.	3	8	10	13	6.0	50
Charleston [4]	48	11	92	1,017.6	1,019.3	−1.4	63	48	55.7	+4.0	77	12	25	26	28	297	46	79	3.32	+.6	1.21	11	1	.0	.0	9.3	n.	29	n.	26	8	5	18	6.5	51
Columbia, S. C. [4]	347	70	91	1,011.5	1,019.6	−1.4	60	42	51.2	+4.0	76	15	20	27	29	437	42	79	3.70	+.7	1.34	12	0	.0	.0	7.7	ne.	23	sw.	16	10	3	18	6.3	37
Greenville, S. C. [3]	1,040	18	36	981.7	1,019.6	−.4	54	38	46.2	+4.0	74	14	17	27	29	583	38	75	4.24	−.6	1.65	13	2	.0	.0	8.2	ne.	34	n.	25	9	4	18	6.0	42
Augusta [4]	182	62	77	1,004.1	1,019.6	−1.1	61	43	52.0	+3.9	78	16	24	26	30	415	41	72	4.88	+1.6	1.31	14	0	.0	.0	5.4	nw.	19	s.	29	10	3	18	6.3	46
Savannah [3]	65	19	51	1,018.0	1,020.0	−.7	67	47	50.7	+6.1	81	13	27	26	28	281	49	80	3.67	+.7	1.46	9	2	.0	.0	9.7	ne.	30	w.	30	8	7	16	6.4	44
Jacksonville [4]	43	86	110	1,018.3	1,019.3	−1.4	71	54	62.7	+6.4	81	12	37	31	33	138	56	86	3.78	+.8	.97	13	2	.0	.0	8.2	sw.	25	nw.	30	5	13	13	6.4	50
FLORIDA PENINSULA									72.5	+5.7								82	1.77	−.1														4.6	
Key West [4]	21	10	64	1,017.6	1,018.0	−.6	80	72	76.0	+5.7	85	9	63	31	13	0	70	83	3.05	+1.4	1.59	7	2	.0	.0	9.1	e.	31	nw.	30	13	11	7	4.6	60
Miami [4]	25	242	249	1,017.6	1,018.0	−1.3	78	68	73.5	+4.4	84	20	45	31	24	15	65	80	.62	−1.4	.15	7	2	.0	.0	12.8	se.	35	ne.	26	17	10	4	4.0	64
Tampa [2]	35	5	36	1,018.6	1,019.0	−1.0	77	59	68.0	+6.9	85	13	44	31	27	44	61	82	1.63	−.4	.85	7	1	.0	.0	7.3	ne.	27	sw.	19	10	15	6	5.2	62
EAST GULF									54.7	+4.4								80	4.43	−.5														6.8	
Atlanta [3]	1,173	33	72	984.4	1,019.6	−1.1	56	40	47.8	+3.6	74	14	22	26	31	532	40	76	4.11	−.7	1.20	13	2	.0	.0	9.4	nw.	35	nw.	19	5	5	21	7.4	34
Macon [4]	370	79	87	1,002.7	1,019.6	−1.1	60	42	51.5	+4.0	78	16	27	27	33	424	44	76	4.90	+.9	2.09	11	0	.0	.0	6.1	n.	22	nw.	30	5	5	21	7.3	39
Thomasville	273	48	....	1,010.5	1,020.7	−.3	67	48	57.8	+5.3	79	15	30	31	33	249	....	..	5.10	+.8	2.26	10	8	.0	.0	....	..	..	.....	..	5	9	17	....	....
Apalachicola	35	11	51	1,018.3	1,019.6	−.7	67	53	60.1	+4.4	74	17	32	31	31	178	55	86	2.43	−2.7	.71	12	1	.0	.0	7.8	ne.	27	n.	25	8	9	14	6.9	33
Pensacola [4]	56	54	79	1,015.2	1,019.6	−1.1	66	51	58.8	+4.8	76	15	30	31	32	221	52	80	3.88	−.8	1.70	11	1	.0	.0	7.3	n.	23	n.	25	6	8	17	6.9	48
Anniston	618	6	32	997.6	1,020.3	.....	58	38	48.1	+2.9	71	13	20	26	36	523	42	82	4.87	−.2	1.00	13	0	T	.0	....	..	..	.....	..	3	14	14	....	....
Birmingham [3]	700	5	63	997.0	1,020.0	−1.3	58	39	48.8	+4.7	72	15	20	26	31	503	42	76	4.28	−.9	1.21	11	1	T	.0	8.6	se.	31	se.	29	5	8	18	6.9	38
Mobile [4]	57	86	161	1,011.9	1,020.0	−.7	66	50	58.0	+5.8	76	7	30	31	31	242	51	82	5.42	+.4	1.53	10	4	.0	.0	10.6	n.	34	n.	25	5	8	18	6.5	42
Montgomery [4]	218	92	105	1,019.6	1,019.6	−1.7	62	46	54.0	+4.6	77	15	27	26	31	356	46	79	3.18	−1.7	1.29	9	0	.0	.0	7.1	e.	21	n.	25	6	10	15	6.5	47
Meridian [4]	375	67	92	1,008.5	1,020.0	−1.0	64	41	52.4	+4.7	80	15	24	31	39	407	45	80	4.39	−.8	1.12	11	4	.0	.0	7.9	s.	..	.....	..	7	3	21	7.0	....
Vicksburg [4]	247	82	102	1,009.5	1,019.0	−2.0	62	44	53.0	+3.0	76	15	27	26	31	386	43	78	4.70	−.6	2.68	8	6	.0	.0	9.2	s.	25	se.	29	6	6	19	7.1	31
New Orleans C. O.	53	76	84	1,017.3	1,019.3	−1.4	68	53	60.6	+5.0	80	15	35	26	30	192	54	84	5.18	+.4	1.41	14	4	.0	.0	6.3	se.	18	n.	25	8	5	18	6.4	49
New Orleans A. P. [2]	30	6	52	1,017.3	1,019.3	.....	69	50	59.8	.....	81	15	35	31	31	211	52	82	5.13	.....	.....	10	4	.0	.0	....	s.	..	.....	..	6	9	16	6.4	....

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR DECEMBER 1948.—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Greatest daily range	Total heating degree days	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Character of day (sunrise to sunset), number of days: Clear	Character of day (sunrise to sunset), number of days: Partly cloudy	Character of day (sunrise to sunset), number of days: Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
WEST GULF	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F	°F.	°F.	°F.	°F.		°F.		°F.		°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p.h.*					*0-3*	*4-7*	*8-10*	*0-10*	%
Shreveport [2]	181	5	64	1,009.8	1,019.0	−1.7	63	42	52.2	+2.9	82	13	27	31	33	425	44	72 77	1.69 2.75	−1.2 −1.5	1.24	6	2	.0	.0	10.1	se.	30	nw.	5	7	7	17	6.4 6.8	53
Fort Smith [2]	463	6	30	1,001.0	1,017.6	−2.4	54	34	43.8	+1.7	80	13	20	10	37	653	32	69	3.74	+1.0	2.90	5	3	.0	.0	9.1	ne.	34	w.	5	8	7	16	6.6	54
Little Rock [2]	265	26	58	1,005.8	1,019.0	−1.7	55	37	45.8	+1.6	78	13	21	26	32	603	37	74	2.70	−1.4	1.04	8	2	*T*	.0	9.2	ne.	27	nw.	16	8	6	17	6.7	41
Austin [2]	621	5	41	996.6	1,018.3	−2.7	67	44	55.4	+4.4	84	12	29	30	41	320	44	70	1.67	−1.0	1.43	5	2	.0	.0	9.6	s.	25	nw.	7	9	15	6.5	61
Brownsville [2]	20	5	54	1,014.6	1,016.6	−1.7	78	58	67.8	+6.6	85	5	40	30	35	70	59	80	.02	−1.8	.01	4	2	0	.0	10.7	se.	33	s.	28	5	9	17	6.7	54
CorpusChristi [2]	44	6	33	1,017.3	1,018.0	−1.6	74	53	63.6	+7.1	86	21	37	31	36	129	54	76	.06	−1.4	.02	4	1	.0	.0	11.3	ne.	34	s.	28	7	9	15	6.4	58
Dallas [2]	488	34	45	999.3	1,018.3	−2.0	61	41	51.0	+3.3	81	13	22	10	36	447	38	64	3.04	+.7	2.50	5	1	.0	.0	11.8	s.	34	sw.	5	10	6	15	6.1	55
Fort Worth [2]	706	40	56	993.6	1,018.3	−1.7	62	41	51.4	+4.9	82	13	24	30	38	435	35	60	.44	−1.4	.29	5	0	*T*	.0						9	9	13	6.1	
Galveston [4]	54	122	129	1,016.9	1,019.0	−1.3	66	55	60.8	+4.4	73	24	38	26	26	157	53	83	.93	−2.8	.35	8	1	.0	.0	11.8	s.	27	se.	28	7	9	15	6.5	41
Houston [4]	138	157	190	1,013.5	1,018.6	−1.7	68	51	59.7	+5.3	82	24	35	30	32	214	50	77	1.38	−2.8	.90	8	1	.0	.0	10.0	s.	27	n.	29	7	6	18	6.6	36
Laredo [2]	418	10	38	1,020.3	1,015.9		75	51	63.3	+7.0	88	15	35	31	41	148	46	62	.01	−1.3	.01	1	0	.0	.0						7	7	15	5.7	
Palestine	510	64	72	1,000.7	1,019.0	−1.3	63	44	53.6	+3.7	80	12	30	30	33	376	42	67	4.70	+1.0	2.75	4	2	.0	.0	8.5	s.	24	s.	4	7	9	15	6.4	50
Port Arthur [4]	34	59	134	1,016.9	1,018.0	−2.0	67	50	58.6	+3.9	78	22	34	31	30	233	50	84	1.98	−3.2	.86	11	7	.0	.0	12.5	s.	30	nw.	5	7	8	16	6.4	43
San Antonio [2]	794	6	51	993.6	1,018.3	−1.3	68	43	55.8	+2.1	82	21	28	30	40	307	42	65	.23	−1.4	.13	4	0	.0	.0	8.2	n.	28	ne.	25	6	8	17	6.7	50
OHIO VALLEY AND TENNESSEE																																				
									38.9	+3.4								77	3.88	+.3													7.2		
Chattanooga [2]	762	6	66	994.9	1,020.3	−1.0	53	36	44.4	+3.5	71	14	19	26	32	636	37	76	5.17	.0	1.21	12	3	T	.0	7.9	s.	32	s.	29	4	8	19	7.3	31
Knoxville [2]	995	27	71	984.1	1,020.3	−.7	51	34	42.4	+3.4	70	14	14	26	27	701	35	76	5.81	+1.3	2.40	14	0	T	.0	8.3	ne.	30	w.	6	4	8	19	7.2	35
Memphis [2]	399	5	49	1,008.8	1,019.3	−1.7	55	37	45.9	+3.5	73	15	20	26	30	598	37	70	2.84	−1.7	.91	11	3	T	.0	9.1	s.	22	n.	25	7	5	19	6.7	39
Nashville [2]	546	5	72	997.3	1,019.6	−1.7	52	35	43.8	+2.8	70	15	15	26	31	657	36	76	5.58	+1.4	2.15	12	0	T	.0	9.0	s.	28	s.	28	5	12	14	6.6	36
Lexington [2]	989	4	58	983.4	1,020.7	.0	46	30	38.0	+2.2	66	14	−1	26	27	837	32	79	4.73	+1.0	2.62	11	0	4.5	.0						6	6	19	7.1	
Louisville [2]	525	5	54	1,002.0	1,019.6	−1.4	48	32	40.1	+3.8	68	15	6	26	31	775	32	74	3.05	−.7	1.66	9	1	4.0	.0	8.5	s.	30	s.	12	5	6	20	7.4	43
Evansville [2]	431	6	40	1,003.4	1,019.6	−1.4	48	32	40.0	+5.2	68	15	10	26	29	777	33	77	3.61	+.1	1.81	8	0	.7	.0	9.2	sw.	28	s.	5	5	9	17	7.1	35
Indianapolis [2]	823	5	54	998.2	1,019.0	−1.0	43	26	34.3	+3.4	69	15	8	26	34	947	28	78	3.18		1.59	10	0	5.6	.0	10.7	nw.	36	sw.	5	6	4	21	7.1	37
Terre Haute [2]	575	4	36	997.6	1,019.0	−1.0	44	27	35.4	+2.9	70	15	8	26	32	919	30	78	3.16	+.2	1.45	9	0	3.2	.0	10.5	n.	36	s.	5	6	5	20	7.1	52
Cincinnati [4]	627	135	148	996.3	1,020.0	−.7	47	33	39.8	+3.4	66	15	12	26	25	783	30	76	3.79	+.8	3.11	7	0	2.1	.0	5.1	nw.	31	nw.	10	5	4	22	7.5	27
Columbus [4]	822	90	110	988.8	1,019.0	−1.0	44	30	36.5	+4.1	65	15	8	26	25	885	28	77	2.24	−.5	1.13	11	1	3.5	.0	8.5	s.	31	sw.	6	6	4	21	7.2	42
Dayton [2]	1,003	6	55	981.7	1,019.3	−.3	41	27	34.0	+2.7	63	15	7	26	28	964	28	78	2.38	−.4	.99	11	1	6.9	.0	12.2	s.	34	w.	5	5	5	21	7.3	37
Elkins [2]	1,947	5	45	948.5	1,019.6	−1.4	45	25	35.2	+3.5	63	13	2	27	43	925	28	84	5.71	+2.2	2.04	15	1	5.7	1.8	7.0	w.	18	se.	5	6	8	17	7.0	28
Parkersburg	637	77	84				46	30	38.2	+3.0	66	13	10	27	30	833	28	76	3.74	+.7	2.69	10	1	3.2	.0	6.0	nw.	39	w.	31	4	7	20	7.4	33
Pittsburgh [2]	842	39	54	987.1	1,019.3	−.3	42	28	35.2	+3.2	62	13	8	26	24	924	27	75	3.25	+.4	1.11	12	1	6.5	1.5	10.2	s.	39	w.						30
LOWER LAKES																																				
									32.1	+3.6								78	2.55	−.2												7.6		
Buffalo [2]	768	34	96	988.2	1,017.3	−.3	38	26	32.4	+3.6	57	5	6	25	19	1,010	26	78	2.05	−1.3	.53	14	0	7.0	2.0	14.6	w.	45	sw.	5	0	7	24	8.4	22
Canton	448	10	61	999.7	1,016.3	−1.0	36	20	28.1	+6.3	57	6	−13	26	34	1,145	22	81	3.02	+.3	1.38	13	0	17.3	8.0	8.4	sw.	30	w.	7	3	5	23	7.9	30
Oswego	335	71	85				38	27	32.2	+4.1	53	5	4	26	23	1,017			3.24	−.3	.86	18	0	20.1	2.0	11.1	s.	33	n.	25	1	7	23	8.4	17
Rochester [2]	523	4	69	997.6	1,017.3	−1.0	34	25	31.2	+2.6	57	5	7	25	26	1,053	24	80	1.63	−1.1	.40	14	0	12.3	2.0	10.8	sw.	30	w.	23	2	7	22	7.8	26
Syracuse [2]	596	5	57	994.9	1,017.6	−.4	39	24	31.2	+3.8	57	5	1	25	32	1,047	24	78	3.28	+.2	.91	17	0	23.1	8.0	10.8	sw.	33	s.	5	2	5	24	8.2	38
Erie [4]	714	57	81	991.2	1,018.0	−.3	40	30	35.2	+3.3	57	5	14	25	20	925	26	76	2.13	−.7	.58	15	0	7.8	T	9.7	s.	24	nw.	31	1	6	24	8.4	15
Cleveland [2]	762	27	54	989.5	1,018.6	.0	40	27	33.8	+4.7	58	4	15	27	27	970	27	77	2.71	+.3	.81	10	0	5.8	.4	12.1	s.	35	sw.	6	3	5	23	8.0	25
Sandusky	629	5	67	994.9	1,019.3	+.3	40	28	34.2	+3.0	59	4	10	26	23	953			1.72	−.6	.77	9	0	3.1	.0	10.7	sw.	34	sw.	6	4	10	17	7.1	36
Toledo [2]	628	5	47	994.6	1,018.6	−.7	39	24	31.8	+2.7	58	4	4	26	30	1,031	26	78	2.35	.0	.95	9	0	2.8	.0	12.2	sw.	42	w.	6	6	8	17	6.6	37
Fort Wayne [2]	857	5	34	986.5	1,018.6	−.7	39	23	31.0	+2.4	55	3	6	26	29	1,056	26	80	3.55	+1.0	1.53	13	1	1.9	*T*	10.0	s.	43	s.	5	7	7	17	6.6	48
Detroit [2]	730	5	77	990.9	1,018.6	.0	37	26	31.7	+2.8	56	4	6	26	20	1,032	24	72	2.35	.0	1.04	9	0	3.6	*T*	12.0	nw.	30	sw.	6	5	12	14	6.5	41
UPPER LAKES																																				
									25.9	+2.5								78	1.71	−.3												6.1		
Alpena	609	5	89	992.9	1,015.9	−1.0	34	22	28.1	+3.3	50	4	−1	26	25	1,142	23	78	1.47	−.6	.67	10	0	12.7	5.7	11.8	w.	35	se.	5	6	8	17	7.0	38
Escanaba	612	51	72	992.6	1,015.9	−1.4	32	18	24.6	+2.2	47	5	1	26	24	1,247	20	78	.56	−1.2	.36	10	0	2.3	1.0	11.5	sw.	40	n.	29	13	8	10	5.0	57
Grand Rapids [4]	707	70	244	990.9	1,017.6	−.7	36	25	30.9	+2.4	59	4	9	26	24	1,058	24	80	2.23	−.3	1.08	11	0	5.3	.7	12.4	sw.	56	sw.	5	5	9	17	6.7	40
Lansing [4]	878	5	90	984.8	1,017.6	−.4	35	22	28.7	+1.8	57	4	2	26	26	1,121	23	78	2.23	+.2	.91	14	0	5.7	2.7	11.1	nw.	36	sw.	6	5	14	12	6.5	45
Marquette	734	44	73	986.8	1,014.6	−2.3	31	18	24.2	+1.6	49	4	0	26	23	1,260	19	77	.72	−1.9	.30	10	0	6.1	2.5	9.6	w.	30	sw.	26	4	12	15	6.7	32
Sault Sainte Marie [2]	614	10	52	991.9	1,015.2	−1.7	30	16	23.0	+4.2	50	4	−10	25	26	1,301	19	82	1.71	−.5	.50	19	0	25.0	10.0	11.8	sw.	37	sw.	26	4	7	20	7.3	37
Chicago [2]	673	5	38	992.6	1,018.0	−1.0	37	23	30.4	+3.5	57	5	6	26	26	1,074	24	77	3.04	+1.0	1.31	10	0	6.8	*T*	11.0	w.	40	sw.	5	8	11	12	6.0	57
Green Bay	617	5	32	993.6	1,016.9	−1.1	31	17	23.9	+1.6	55	4	−2	31	25	1,271	17	72	1.43	−.3	.52	9	0	7.9	4.0	9.5	sw.	31	s.	5	13	7	11	5.1	63
Milwaukee [2]	681	33	66	991.9	1,018.3	.0	35	21	28.0	+3.3	55	5	6	25	26	1,147	22	75	2.50	+.8	1.02	10	0	2.8	*T*	14.9	sw.	56	sw.	6	5	9	12	5.6	55
Duluth [4]	1,133	5	47	972.2	1,015.2	−2.8	25	9	16.8	+.9	44	4	−16	10	30	1,495	11	83	1.19	.0	.51	9	0	6.7	2.9	12.7	w.	36	w.	6	15	3	13	5.3	53
NORTH DAKOTA																																				
									10.0	−1.9								85	.63	.0												6.2		
Fargo [2]	940	5	47	980.0	1,016.3	−3.3	21	2	11.8	+.3	43	2	−22	25	32	1,655	9	88	.37	−.4	.11	8	0	3.8	4.0	12.6	s.	34	n.	21	11	4	16	6.1	54
Bismarck [2]	1,677	5	41	953.3	1,017.3	−2.7	23	−1	11.1	−1.7	57	2	−20	23	39	1,667	3	84	.36	−.2	.19	9	0	5.9	3.2	10.3	e.	36	nw.	20	9	9	13	5.9	57
Devils Lake	1,478	11	44	959.7	1,016.6	−2.4	16	−1	7.6	−1.9	41	2	−22	9	31	1,777	5	83	.79	+.2	.19	11	0	14.2	11.5	9.6	sw.	28	ne.	20	8	7	16	6.4	44
Williston	1,878	42	50	945.5	1,015.6	−3.4	19	0	9.6	−4.2	55	2	−21	9	40	1,719	6	85	1.01	+.4	.32	12	0	15.0	7.0	6.3	w.	27	w.	20	7	10	14	6.5	57
UPPER MISSISSIPPI																																				
									29.1	+2.7								78	2.10	+.4												6.0		
Minneapolis-St. Paul [2]	919	43	74	981.4	1,016.6	−1.7	25	12	20.0	+.4	56	3	−11	10	34	1,396	14	78	.67	−.3	.49	8	0	2.3	2.0	10.5	w.	33	w.	5	9	6	16	6.2	43
La Crosse [2]	672	5	29	990.2	1,017.3	−1.7	30	12	21.0	+.6	50	3	−15	30	35	1,364	17	80	1.36	.0	.67	7	0	8.8	6.0	9.3	s.	35	w.	5	11	8	12	5.7	57
Madison [2]	974	27	39	980.7	1,017.6	−1.7	33	17	24.8	+2.4	54	5	−5	26	26	1,249	19	76	1.75	+.1	.55	9	1	4.3	2.5	11.9	w.	50	sw.	5	9	8	14	5.8	53
Charles City	1,015	10	51	979.7	1,018.3	−1.3	31	15	23.0	+2.6	56	3	−7	30	28	1,298			2.34	+1.0	1.35	7	0	10.4	6.2	7.0	w.	27	w.	5	12	5	14	5.4	53
Moline [2]	606	6	50	994.9	1,018.3	−1.7	37	21	29.0	+3.3	57	4	2	10	29	1,114	22	75	2.21	+.7	1.48	8	1	6.2	3.0	9.6	w.	47	sw.	5	10	7	14	5.7	52
Des Moines [4]	860	5	99	985.8	1,018.3	−1.3	36	20	28.3	+2.3	62	4	−3	10	34	1,138	22	82	1.89	+.7	.52	10	2	8.9	1.0	9.8	nw.	34	w.	5	10	5	16	6.2	48
Dubuque	699	60	79	991.5			35	19	27.0	+2.3	56	5	−2	26	30	1,178	21	77	1.86	+.4	.57	6	1	4.3	1.6	5.9	nw.	21	s.	5	13	5	13	5.5	61
Burlington [2]	702	4	36	991.9	1,018.3	−1.7	38	21	29.3	+2.0	58	4	−2	26	29	1,104	24	84	1.53	−.1	.49	9	1	6.0	1.0	10.5	s.	52	sw.	5	9	7	15	6.2	51
Cairo	357	5	99	1,006.1	1,019.3	−1.4	50	36	43.2	+5.4	68	12	18	26	25	674			5.03	+1.6	1.42	9	1	T	.0	10.4	s.	29	s.	5	4	13	14	7.0	51
Peoria [2]	609	7	26	995.6	1,019.0	−1.0	40	23	31.4	+3.3	62	13	2	10	27	1,040	25	76	2.61	+.8	1.16	9	1	2.0	T	11.9	s.	48	sw.	5	6	12	13	6.3	52
Springfield, Ill. [4]	636	5	191	994.9	1,018.6	−1.4	42	25	33.8	+4.1	72	15	2	26	32	970	28	79	1.90	−.3	.71	10	0	2.4	.0	12.5	s.	62	sw.	5	6	7	18	6.5	62
St. Louis [4]	568	33	59	997.6	1,018.6	−1.7	47	31	38.8	+3.9	75	15	9	26	35	815	30	73	2.01	−.2	.52	9	1	5.1	.0	12.8	s.	45	s.	5	8	13	10	5.8	50

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR DECEMBER 1948.—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Extremes: Highest	Date	Lowest	Date	Greatest daily range	Total heating degree days	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
MISSOURI VALLEY	Ft.	Ft.	Ft.	Mb.	Mb.	Mb.	°F.	°F.	°F.	°F.	°F.		°F.		°F.		°F.	%	In.	In.	In.			In.	In.	m. p.h.					0-3	4-7	8-10	0-10	%
Columbia, Mo. [4]	784	6	66	988.8	1,018.0	−2.0	46	27	36.6	+2.6	75	13	−7	26	38	880	28	79	1.09	.0														6.1	
Kansas City [3]	963	38	76	989.8	1,018.0	−2.3	45	27	35.8	+3.3	73	13	−1	26	34	907	25	77	1.46	−.4	.55	5	0	7.2	.0	7.8	s.	34	s.	5	7	7	17	6.8	48
St. Joseph [2]	867	5	66	989.8	1,018.0	−2.3	45	27	35.8	+3.3	73	13	−1	26	34	907	25	66	1.20	.0	.53	7	1	6.9	T	10.2	nw.	43	sw.	5	8	6	17	6.5	46
Springfield, Mo. [3]	867	5	51	987.5	1,017.6	−2.4	43	22	32.3	+2.7	66	4	−13	25	40	1,014	24	77	1.15	−.1	.58	8	1	8.8	T	8.0	nw.	39	w.	5	10	8	13	5.7	51
Topeka [4]	1,324	5	50	971.6	1,018.3	−1.7	47	29	38.1	+2.6	77	13	11	26	39	836	28	70	2.01	−.3	1.18	6	2	T	.0	13.7	s.	45	sw.	5	7	9	15	6.6	45
Lincoln [4]	987	65	87	981.0	1,017.6	−2.4	45	26	35.2	+3.2	67	13	4	26	32	923	26	76	1.05	+.1	.75	8	1	5.5	.0	9.0	s.	34	w.	5	7	11	13	6.1	45
Norfolk, Nebr. [2]	1,189	6	81	973.2	1,017.6	−2.4	37	19	27.8	+.2	61	4	−8	25	41	1,152	22	86	1.22	+.4	.47	7	0	15.0	2.2	8.6	s.	37	nw.	5	9	5	17	6.5	46
Omaha [3]	1,551	5	38	959.7	1,017.6	-----	31	11	20.6	−3.9	48	3	−15	30	44	1,378	18	86	1.19	+.4	.30	7	0	14.5	11.0	----	nw.	----	----	----	13	4	14	5.7	...
Valentine	1,105	5	68	980.7	1,017.6	−2.7	37	18	27.6	+1.2	63	4	−7	25	35	1,161	22	80	1.03	+.1	.35	7	0	12.4	4.0	10.9	s.	40	n.	28	10	6	15	6.1	42
Sioux City [2]	2,598	46	54	921.8	1,017.3	−2.7	35	12	23.7	−.9	70	3	0	29	40	1,282	16	75	.57	.0	.41	3	0	10.3	5.8	8.8	w.	30	n.	28	10	11	10	5.7	59
Huron [2]	1,138	5	40	976.0	1,017.6	−2.4	32	11	21.2	−.4	54	4	−10	30	38	1,359	18	88	.90	.0	.34	11	0	8.8	5.0	10.1	e.	38	nw.	5	12	3	16	5.9	55
	1,301	5	41	967.8	1,016.6	−3.7	30	8	19.1	+.4	53	3	−6	9	32	1,425	14	88	.17	−.4	.14	3	0	2.5	T	11.5	nw.	41	se.	10	10	6	15	6.0	49
NORTHERN SLOPE									17.3	−5.7								76	.72	+.1													6.5	
Billings [3]	3,570	16	39	886.9	1,015.2	−5.5	29	11	20.4	−5.8	55	2	−4	23	30	1,385	11	66	.71	-----	.49	8	0	14.0	1.0	11.4	sw.	47	nw.	20	7	8	16	6.4	40
Butte	5,533	44	58	823.9	1,020.7	-----	23	−4	9.4	−11.0	39	2	−28	23	44	1,725	7	86	.94	+.5	.64	11	0	15.1	6.0	----	s.	----	----	----	5	2	24	7.8	...
Glasgow	2,086	34	53	938.7	1,017.3	-----	21	−1	9.9	−5.7	58	2	−29	18	43	1,704	5	81	1.00	+.5	.26	9	0	11.7	3.0	----	nw.	----	----	----	8	10	13	6.0	...
Great Falls [3]	3,657	16	75	883.2	1,014.2	-----	27	10	18.4	−9.6	48	2	−14	14	35	1,445	11	70	.53	−.1	.33	7	0	5.8	T	16.4	sw.	63	sw.	19	6	11	14	6.3	57
Havre	2,507	11	67	923.1	1,016.9	−2.7	21	0	10.4	−10.0	51	2	−21	17	49	1,690	6	80	.52	−.1	.28	8	0	7.3	T	8.0	w.	34	sw.	1	8	5	18	6.4	44
Helena [3]	4,124	5	43	869.6	1,019.3	−1.4	23	3	12.8	−9.9	46	2	−17	24	42	1,619	7	78	.80	+.3	.43	12	0	13.2	5.0	6.8	w.	39	w.	20	4	7	20	7.1	51
Missoula [3]	3,263	4	32	899.8	1,019.3	−2.7	24	4	13.7	−7.7	42	2	−21	26	33	1,592	12	90	1.04	+.1	.26	15	0	15.2	9.0	4.6	se.	29	nw.	20	4	6	21	7.6	33
Kalispell	2,973	48	56	908.9	1,016.3	−3.7	26	13	19.4	−5.5	42	2	−4	24	26	1,416	15	80	1.02	−.4	.30	15	0	14.9	3.0	4.7	nw.	28	w.	20	0	8	23	8.5	15
Miles City [2]	2,371	5	28	929.2	1,017.6	−2.4	24	4	14.0	-----	54	2	−20	18	39	1,584	9	81	.31	-----	.14	6	0	7.7	4.0	----	w.	----	----	----	9	11	11	5.6	...
Rapid City [3]	3,259	5	56	899.4	1,016.3	−4.0	34	12	23.1	−2.0	68	3	0	15	37	1,300	14	74	.48	.0	.31	6	0	5.9	1.0	13.8	nw.	51	nw.	19	9	8	14	5.9	61
Cheyenne [3]	6,094	22	40	805.6	1,015.2	−3.8	37	16	26.4	−2.1	59	3	0	24	35	1,199	13	60	1.03	+.5	.42	6	0	12.4	4.0	14.4	nw.	61	nw.	20	10	10	11	5.6	38
Lander [2]	5,352	6	30	823.9	1,016.9	−5.1	28	8	18.3	−2.1	52	2	−17	26	35	1,446	10	68	.59	−.1	.34	4	0	8.8	3.0	4.3	sw.	28	sw.	3	10	12	9	5.2	59
Sheridan [2]	3,790	5	38	874.0	1,016.6	−4.7	32	9	20.6	−2.2	63	2	−5	17	39	1,376	11	72	.32	−.3	.13	7	0	5.4	1.0	7.6	nw.	45	nw.	20	8	9	14	6.1	48
North Platte [3]	2,821	11	51	914.7	1,016.9	−3.4	37	14	26.0	−.7	62	3	0	31	43	1,210	18	78	.80	+.3	.38	3	0	10.0	6.0	9.5	w.	44	nw.	28	7	8	16	6.7	48
MIDDLE SLOPE									36.1	+2.1								65	.46	−.5													5.7	
Denver [4]	5,292	106	113	832.0	1,014.6	−4.0	43	21	32.4	+.1	69	3	5	25	39	1,011	13	52	.40	−.3	.33	5	0	4.3	T	7.5	s.	30	w.	20	8	15	8	5.2	66
Pueblo [3]	4,690	5	36	849.3	1,015.6	−3.4	49	16	32.3	+2.2	68	13	−4	25	56	1,015	13	52	.25	−.2	.21	2	0	4.0	T	9.0	nw.	43	sw.	4	8	16	7	5.3	54
Concordia	1,392	50	58	966.1	1,017.6	−2.7	41	23	31.9	+1.2	59	4	5	10	35	1,030	24	73	.46	−.2	.19	7	0	6.4	T	8.6	sw.	32	nw.	5	13	6	12	5.4	69
Dodge City [3]	2,509	5	58	923.8	1,017.3	−3.4	43	24	33.2	+.6	68	13	16	30	34	988	24	76	.19	−.4	.13	3	0	.9	.0	14.5	sw.	46	nw.	5	10	7	14	5.9	68
Wichita [3]	1,358	52	64	965.8	1,016.9	−2.7	46	27	36.8	+2.2	70	14	16	30	33	871	26	68	.25	−.8	.23	2	0	1.0	.0	14.5	s.	43	nw.	5	9	10	12	6.1	61
Oklahoma City [4]	1,214	10	47	973.2	1,017.6	−2.4	54	34	43.8	+4.5	77	13	20	30	42	660	30	67	.30	−1.2	.12	7	0	T	.0	10.5	s.	26	s.	27	11	7	13	5.5	53
Tulsa [3]	674	10	60	992.9	1,017.6	-----	54	32	42.5	+3.7	80	13	16	30	41	699	32	68	1.35	−.6	.57	7	1	T	.0	12.2	s.	47	nw.	28	7	10	14	6.3	57
SOUTHERN SLOPE									47.8	+4.0								55	.31	−.7													6.0	
Abilene [3]	1,755	4	59	955.3	1,017.3	−2.7	62	38	50.3	+5.2	82	13	19	30	40	462	32	56	.78	−.6	.46	4	1	T	.0	15.0	s.	42	nw.	5	6	6	19	6.9	53
Amarillo [3]	3,604	5	42	887.8	1,015.6	−3.7	54	27	40.6	+5.1	73	13	17	29	40	756	25	59	.09	−.7	.07	3	0	.2	.0	15.1	sw.	54	w.	4	8	6	17	6.4	38
Del Rio	960	63	71	983.4	1,017.3	−2.0	68	46	57.2	+5.0	82	12	31	30	42	252	40	58	.15	−.5	.09	5	0	.0	.0	7.6	se.	22	nw.	7	6	14	11	6.1	46
Roswell	3,614	6	29	891.3	1,016.3	−3.0	60	28	44.0	+2.8	77	22	10	1	56	651	21	46	.15	−.5	.12	3	0	1.8	.0	8.1	s.	47	w.	4	10	8	13	5.5	57
Wichita Falls	1,030	4	49	980.0	1,017.3	-----	59	35	47.1	+2.1	84	13	21	30	40	561	30	58	.37	−1.2	.30	2	1	T	.0	----	----	----	----	----	10	14	7	5.5	...
SOUTHERN PLATEAU									45.3	+1.0								50	1.02	+.1													5.8	
El Paso [3]	3,916	35	85	887.2	1,016.3	−2.3	59	37	47.8	+4.1	68	12	22	6	42	533	27	48	.86	+.3	.58	4	0	T	.0	9.7	sw.	47	w.	4	13	3	15	5.9	59
Albuquerque [3]	5,314	5	45	837.5	1,015.6	−4.0	49	27	38.2	+3.7	63	11	18	5	37	836	20	50	.11	−.4	.05	4	0	.2	.0	9.2	se.	43	sw.	4	8	11	12	6.0	66
Flagstaff	6,907	34	48	789.0	1,019.3	+1.3	44	17	30.7	+1.1	55	9	−2	24	43	1,063	18	58	3.38	+1.4	1.58	10	0	22.2	12.0	----	w.	----	----	----	10	8	13	5.7	...
Pheonix [4]	1,107	39	87	977.3	1,017.3	.0	64	40	52.0	.0	76	12	29	5	41	407	30	51	.58	−.4	.27	6	0	.0	.0	5.6	e.	23	w.	4	9	9	13	5.9	66
Tucson [3]	2,555	5	39	927.5	1,016.9	−.4	64	38	51.2	+.5	76	13	23	5	43	428	30	50	.93	−.1	.28	7	0	.0	.0	7.9	se.	38	e.	30	10	3	18	6.0	57
Yuma	142	9	54	1,009.8	1,017.3	−.3	64	40	51.9	−3.3	73	12	32	24	36	406	31	45	.26	−.3	.17	3	0	.0	.0	5.5	n.	28	w.	4	15	5	11	4.8	72
MIDDLE PLATEAU									25.2	−3.6								75	1.19	+.2													7.2	
Ely [3]	6,262	8	41	806.3	1,019.6	-----	33	4	18.9	−5.6	53	2	−17	24	47	1,430	14	76	.92	.0	.29	10	0	18.9	6.0	11.8	s.	35	s.	3	4	9	18	6.7	57
Reno [3]	4,527	20	52	861.2	1,019.0	−2.3	41	13	27.0	−4.9	60	2	0	15	44	1,175	20	74	.72	−.3	.29	8	0	8.6	2.0	6.8	s.	52	sw.	2	3	10	18	7.2	44
Winnemucca	4,339	5	56	866.9	1,018.6	−3.8	37	16	26.4	−3.6	56	2	−7	24	37	1,197	20	75	.96	−.1	.28	9	0	16.5	2.0	9.6	sw.	34	sw.	12	4	7	20	7.7	41
Salt Lake City [3]	4,357	32	58	866.2	1,019.0	−3.0	34	16	25.2	−5.0	51	13	−4	25	28	1,232	20	79	2.63	+1.2	.75	16	1	34.3	11.0	9.3	se.	34	s.	3	2	9	20	7.5	46
Grand Junction [3]	4,602	5	26	851.7	1,020.0	−.7	38	18	28.4	+.9	57	14	5	25	32	1,134	19	70	.70	+.1	.40	8	0	9.6	2.8	6.5	e.	35	sw.	14	3	12	16	7.1	49
NORTHERN PLATEAU									23.9	−6.5								84	2.32	+.4													7.7	
Baker [4]	3,471	36	54	894.3	1,019.6	−2.8	29	11	20.0	−7.3	41	11	−11	23	29	1,394	14	84	1.80	+.1	.56	12	0	27.4	10.0	5.6	se.	33	s.	1	3	12	16	7.1	37
Meacham	4,056	7	28	873.0	1,017.3	-----	28	16	22.4	-----	37	7	0	24	21	1,318	20	88	5.41	-----	.87	23	0	68.8	42.0	----	se.	----	----	----	2	5	24	8.4	...
Boise [3]	2,739	5	49	920.4	1,019.3	−4.1	33	18	25.5	−4.8	48	2	0	23	29	1,226	21	81	2.11	+.5	.73	16	0	13.8	T	10.6	se.	36	se.	7	6	8	17	6.9	46
Lewiston	1,436	4	23	964.4	1,018.0	-----	35	22	28.5	-----	46	12	5	27	23	1,135	23	78	1.46	-----	.44	9	0	10.9	.0	----	e.	----	----	----	5	4	22	7.6	...
Pocatello [3]	4,478	5	31	861.5	1,020.3	−2.4	31	14	22.2	−3.1	50	2	−10	25	34	1,329	16	76	1.12	.0	.38	17	0	13.0	2.0	13.1	sw.	41	sw.	20	3	5	23	7.8	34
Ellensburg [2]	1,735	5	58	952.9	1,018.0	-----	28	10	19.0	−9.6	40	19	−16	27	27	1,425	18	94	1.83	+.3	.59	16	0	30.5	12.0	----	nw.	----	----	----	4	8	19	7.6	...
Spokane [2]	1,929	6	51	945.5	1,016.9	−3.4	28	15	21.5	−9.0	42	1	−3	24	24	1,345	20	89	3.13	+.9	.76	19	0	33.2	14.0	7.5	sw.	36	sw.	19	5	1	25	8.2	23
Walla Walla	991	57	65	980.7	1,018.0	−2.7	37	26	31.8	−3.7	54	1	8	25	23	1,028	-----	----	2.69	+.6	.90	12	0	10.4	.0	5.9	s.	22	s.	1	2	6	23	7.9	33
Yakima [3]	1,076	4	54	977.3	1,017.3	−2.7	35	13	24.0	−8.2	51	1	−2	27	35	1,272	20	83	1.34	+.4	.82	10	0	15.0	4.2	----	w.	27	w.	19	5	4	22	7.5	...

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR DECEMBER 1948.—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Extremes: Highest	Date	Lowest	Date	Greatest daily range	Total heating degree days	Mean temperature of the dw point	Mean relative humidity	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Maximum velocity: Miles per hour	Direction	Date	Character of day (sunrise to sunset), number of days: Clear	Partly cloudy	Cloudy	Average cloudiness, tenths (sunrise to sunset)	Possible sunshine
NORTH PACIFIC COAST	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F*		°*F.*		°*F*		°*F.*	%	*In.*	*In.*	*In.*			*In.*	*In.*	*M. p. h.*					*0–3*	*0–7*	*8–10*	*0–10*	%
									36.3	−3.6								84	7.97	+1.1														7.9	
Kelso [2]	750	38	76				42	31	36.6		50	9	18	27	22	884	33	87	10.75		1.85	23	0	T	.0		s.				1	4	26	8.6	
North Head	211	5	55	1,006.4	1,014.2	−2.4	44	36	40.1	−4.0	50	1	30	18	12	772	35	83	12.46	+3.0	2.05	25	1	T	.0	16.4	e.	52	s.	1	3	10	18	7.4	33
Seattle [4]	125	90	321	1,010.2	1,014.6	−2.7	43	34	39.0	−3.6	49	10	21	24	21	808	33	83	4.56	−1.0	.80	19	0	2.6	.0	11.2	s.	30	s.	1	2	8	21	7.8	25
Tacoma	194	172	201	1,007.5	1,014.6	−2.7	42	33	37.8	−2.8	49	1	19	24	18	847			7.03	+.3	1.51	20	1	4.3	.0	9.5	s.	34	s.	19	4	8	19	7.5	26
Tatoosh Island	86	5	61	1,009.5	1,012.9	−2.3	43	36	39.4	−4.5	50	1	33	21	13	795	35	83	13.10	−.3	3.12	24	0	.6	.0	18.0	e.	54	s.	19	4	3	24	8.0	23
Burns	4,162	35	47	871.0	1,018.3	.....	30	10	20.2	−6.1	48	2	−8	24	28	1,388	17	83	2.58	+1.2	.69	16	0	19.4	7.0	.....	n.	..	.....	..	4	7	20	7.2	...
Eugene [3]	433	4	35	1,003.4	1,017.6	.....	42	30	36.2	.....	53	7	17	24	21	894	34	91	8.67	.....	1.86	22	0	1.0	.0	.....	s.	..	.....	..	2	5	24	8.0	...
Medford [3]	1,329	29	58	970.2	1,019.3	−.7	43	28	35.4	−2.7	56	11	12	23	27	920	30	83	3.69	+.8	1.17	14	0	1.2	.0	.....	n.	..	.....	..	3	5	23	7.9	...
Portland, Oreg. [4]	154	68	106	1,010.8	1,016.6	−2.4	43	35	39.4	−1.8	54	7	25	27	14	795	32	79	10.04	+3.3	1.61	22	0	.3	.0	7.4	s.	26	sw.	10	3	6	22	7.9	21
Roseburg	510	45	76	999.0	1,018.0	−1.6	44	33	38.6	−3.2	57	11	22	24	24	818	.....	..	6.83	+1.5	1.53	16	0	T	.0	3.8	s.	18	sw.	11	2	3	26	8.8	11
MIDDLE PACIFIC COAST																																			
									44.2	−3.7								80	5.39	+1.0														7.4	
Eureka	60	72	88	1,018.0	1,020.3	+.3	50	38	44.0	−4.2	56	28	28	23	22	647	39	80	7.35	+1.1	1.74	20	0	.0	.0	6.7	se	30	sw.	5	6	8	17	7.1	41
Red Bluff [3]	353	5	26	1,006.4	1,019.6	.....	49	35	42.0	−4.1	65	1	23	24	27	711	34	76	4.58	+.2	1.46	13	0	4.9	.0	7.3	nw.	42	se.	5	4	5	22	7.5	41
Sacramento [4]	66	92	115	1,017.6	1,020.0	.0	49	37	43.2	−3.0	65	1	27	24	28	679	38	85	4.88	+1.8	1.56	15	0	.0	.0	6.4	se.	23	se.	5	3	4	24	8.1	22
San Francisco [4]	155	112	132	1,013.9	1,019.6	+.3	52	43	47.8	−3.5	63	1	37	24	15	534	41	81	4.75	+.8	1.02	14	0	.0	.0	7.2	n.	27	e.	25	6	9	16	6.7	37
SOUTH PACIFIC COAST																																			
									50.5	−1.9								74	1.94	.0														6.1	
Fresno [3]	327	5	34	1,008.5	1,020.7	+.4	52	36	44.4	−.7	69	2	28	24	35	637	38	81	1.23	−.2	.56	13	0	.0	.0	3.9	se.	22	nw.	3	2	6	23	8.1	32
Los Angeles	338	236	263	.....	.....	.....	63	43	53.4	−3.2	83	9	35	24	33	367	.....	...	2.20	−.4	1.10	6	1	.0	.0	7.5	e.	35	se.	26	12	9	10	5.1	75
San Diego [3]	87	20	55	1,014.9	1,018.3	+.7	63	45	53.6	−1.9	76	2	37	24	31	353	43	68	2.38	+.5	.79	7	0	.0	.0	5.6	ne.	24	s.	17	13	6	12	5.2	61
ALASKA																																			
Anchorage [3]	132	6	44	1,000.0	1,005.1	.....	13	−1	5.8	−7.5	30	17	−18	7	30	1,836	5	84	.50	−.4	.12	10	0	11.1	9.0	4.7	n.	24	n.	1	7	2	22	7.4	...
Annette Island	113	5	53	1,002.0	1,006.1	.....	34	24	28.8	−7.3	42	18	6	14	17	1,124	26	86	7.91	−2.0	2.08	19	0	26.6	7.0	.....	n.	..	.....	..	1	7	23	8.3	...
Barrow	29	5	27	1,013.2	1,013.9	.....	−14	−27	−20.6	−8.7	18	13	−46	2	32	2,655	−20	82	.18	−.1	.12	5	0	2.2	12.0	7.6	e.	34	e.	25	16	6	9	3.9	...
Bethel [3]	28	5	31	1,004.2	1,005.8	.....	13	−4	4.6	−2.4	36	16	−44	31	48	1,871	4	88	1.59	+.8	.73	13	0	15.3	12.0	11.5	s.	..	.....	..	8	2	21	7.1	...
Cordova [3]	45	5	32	998.6	1,000.7	.....	.....	.....	.....	.....	38	22	−19	7	39	1,583	14	95	3.32	−4.6	.66	17	0	49.1	26.0	.....	e.	27	se.	22	0	3	19	6.6	...
Fairbanks [3]	455	5	63	992.9	1,011.5	.....	−8	−23	−15.6	−8.5	19	18	−37	6	43	2,497	.....	...	1.09	+.5	.32	11	0	21.1	17.0	2.5	nw.	17	w.	22	9	3	19	6.5	...
Galena	139	4	66	1,002.6	1,007.8	.....	−4	−19	−11.8	−1.4	22	12	−46	1	33	2,381	.....	72	.98	+.1	.27	13	0	12.3	25.0	.....	n.	35	se.	24	7	4	20	7.1	...
Gambell	32	5	32	1,004.4	1,005.4	.....	17	6	11.7	+3.0	33	12	−20	28	30	1,652	10	94	.66	.0	.....	12	...	6.5	9.0	20.0	ne.	50	se.	12	2	2	28	9.0	...
Juneau [3]	80	6	30	1,005.1	1,006.1	.....	25	14	19.1	−9.0	38	18	−16	8	24	1,423	15	78	2.95	−1.2	.85	16	0	35.9	14.0	9.1	n.	43	se.	22	6	0	25	7.9	...
Kotzebue [3]	20	5	31	1,007.5	1,008.1	.....	−1	−14	−7.4	−3.4	21	14	−35	31	30	2,244	−10	84	.54	+.2	.....	16	...	5.4	13.0	14.0	ne.	54	se.	24	9	6	16	6.0	...
McGrath [3]	341	5	31	995.6	1,009.1	.....	−4	−22	−12.8	−5.6	32	17	−49	2	37	2,412	−8	78	1.56	+.2	.42	15	0	28.1	40.0	.....	n.	20	s.	21	10	2	19	6.5	...
Nome [3]	22	10	75	1,004.4	1,005.1	.....	13	−7	2.8	−4.7	31	17	−41	1	39	1,928	4	96	1.44	+.3	.53	18	0	13.9	39.0	.....	e.	49	e.	17	5	2	24	7.7	...
Northway [3]	1,718	5	32	945.5	1,013.5	.....	−17	−35	−25.8	−10.4	11	22	−59	7	38	2,814	.....	...	.55	+.2	.19	9	0	9.3	22.0	.....	nw.	..	.....	..	8	4	19	6.9	...
HAWAII																																			
Honolulu [4]	38	86	98	1,016.9	1,018.3	.....	76	69	72.4	.0	78	5	65	23	10	0	61	68	3.11	−.8	.64	26	0	.0	.0	13.4	ne.	37	e.	2	4	14	13	6.0	64

[1] Height of barometer cistern above mean sea level on January 1, 1900, or when station was first established since January 1, 1900. When station is moved to new location or airport, the pressure is reduced to the original elevation for homogeneity. These elevations do not represent the present station elevation in most cases.

[2] Data are from airport records. Pressures adjusted to original elevations according to note 1.

[3] Barometric, hygrometric, wind, character of day, and average cloudiness data from airport records; remainder from city office records.

[4] Barometric and hygrometric data from airport records; remainder from city office records.

[5] Barometric, temperature, degree day, and hygrometric data from airport; remainder from city office records.

NOTE.—Unless otherwise indicated, data in table are city office records.

SEVERE LOCAL STORMS FOR DECEMBER 1948

[The table hereunder contains such data as have been received concerning severe local storms that occurred during the month. A revised list will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Colorado, entire State	4–5					Blowing snow and dust.	Winds, reaching "gale" intensity in north-central portion, resulted in heavy soil movement in drier areas and drifting of snow. Damages comparatively light, considering intensity and scope of storm, and limited to grain fields and buildings. At Fort Collins, roofs of 3 buildings damaged to extent of $2,000, and about $500 damage to roofs and windows. Six baggage cars of Colorado and Southern passenger train blown off track 28 miles north of Fort Collins.
Minnesota, extreme southwest.	4–5			2	$25,000	Ice, sleet, snow, and wind.	Many poles and wires down; communication and electric services disrupted from ½ to 48 hours. Traffic seriously delayed. Ice began to form about 1 a. m. of 5th and remained on wires in some localities until 8th. Thickness of ice on wires varied from ⅛s to 1 inch in diameter. Heaviest ice formation was in Lyon County. Two persons killed and 2 others seriously injured when tree was blown on automobile. Unusual weight of ice and high winds, resulted in considerable damage to overhead wire-systems, amounting to about $25,000 loss. About 254 poles down and more than 328 telephone circuits out of service.
Illinois	5	Afternoon				Wind	Many trees blown down, utility services interrupted, and windows broken; airplane damaged in Waukegan; 1 industrial chimney blown down in Rock Island-Moline area. Other areas affected were Freeport, Lincoln, and Springfield.
Eastern and southern Wisconsin.	5	Afternoon and evening.			$19,200	do	6 persons injured in the Milwaukee area. Many plate glass windows broken; several electric signs and billboards partially destroyed; utility poles and trees toppled. 3 concrete walls under construction fell; a partially built dwelling collapsed; a barn blown down. There were numerous power failures due to fallen lines, disrupting radio broadcast stations in the Madison area; long distance telephone circuits were disrupted; 500 telephones put out of service in the central and southern portions of the State. In Racine, a small barn was damaged; a small boat on pier blown into the Lake; several plate glass windows broken. At Werely Airport, near Burlington, a trainer airplane was badly damaged.
Missouri, entire State	5	All day				do	Unusually strong wind from southwest, resulting in widespread, but mostly minor damage. In St. Louis and vicinity trees and wires blown down or broken, plate glass windows and street lights broken, and cornices and roofs of some buildings damaged; damage several thousand dollars. At Fulton and in Callaway County roofs and cornices damaged, windows broken, barn blown down, a church moved 15 feet off its temporary foundation, wires and tree limbs broken, and haystacks blown down; damage over $5,000. At municipal airport, Jefferson City, new hangar suffered $1,000 to $1,500 damage; some wires and trees damaged. At Martinsburg roofs and trees damaged and haystacks blown down; store roof partly torn off. At Columbia and in Boone County trees, wires, and window glass broken and Christmas street decorations blown down. Barn near Sturgeon demolished, killing 9 calves and several pigs. Boundary lights and storm windows at municipal airport damaged. At Shelbina and over greater part of Shelby County about 30 roofs, windows, and porches damaged; a few outbuildings and a windmill blown down; also a few telephone and electric poles. In Camdenton and Lake of Ozarks area shingles blown from roofs and numerous trees blown down. At Lakeside some damage to trees, roofs, power lines, etc.; loss within 8-mile radius, $3,000. At Joplin numerous trees damaged and a barn blown down.
Iowa, western and northern portions.	5			2		Snow and ice	Snow, ice, and biting winds slowed traffic; driving hazardous in northern half. Heaviest snow in west, with over 3 inches at Sioux City. 2 persons killed in automobile accidents caused by slippery pavements. Lowest barometer readings of record for any December recorded at Des Moines and Charles City, with readings of 28.97 and 28.85 inches respectively.
Southern Wisconsin	14–15	Afternoon of 14th to early morning of 15th.		3		Sleet and freezing rain.	1 person killed in Milwaukee County, 2 in Hancock, and 1 child badly injured in traffic accidents.
Allegany and Garrett Counties, Md.	14–15					Ice	Continuous rain froze on wires and trees, creating havoc in mountainous sections. Travel and walking extremely dangerous and communications out entirely in several areas. Telephone and power lines broken by ice.
Pennsylvania	15–16			2		do	Glaze broke and disrupted utility lines, particularly at Johnston, Somerset, Springs, Harrisburg, and Wellsville. Many tree limbs broken. At Johnston, heavy ice broke trees up to 16 inches thick; also, tower toppled killing 2 repairmen. Property damage in thousands of dollars.
Ohio, central and southern counties.	15–16					Rains	Lowlands flooded, also basements in some residences. Some low places on roads covered with water. Damage apparently minor.
Michigan	16–17	Night				Winds	Considerable damage in many communities. Communications and power services interrupted. Trees blown down, obstructing roads. Great Lakes steamers took shelter behind breakwaters to escape winds. Ferry traffic across Straits and Lake Michigan unable to maintain schedule. An unusual seiche in Great Lakes, with low water at Bay City laying bare city's water intakes that extend into Saginaw Bay.
Ocean and Monmouth Counties, New Jersey.	19					Snow, ice, and winds.	Snow froze on communication lines and trees causing them to break with only moderate wind, especially in Lakewood vicinity. Damage from this source estimated at $50,000. Damage to roofs, etc., from moderately strong winds on several days probably considerable. Icy roads on several days also caused numerous accidents, resulting in damages.
West Virginia, mountain and northeastern sections.	19					Snow	Almost all traffic stalled on U. S. Routes 11, 50, and 340.
Barnstable County and Martha's Vineyard, Mass.	19–20	11 p. m.–4 a. m.			$250,000	Snow and gales	Heavy wet snow and rain froze on telegraph, telephone, and power lines and on highway surfaces. In Cape Cod area between Cape Cod Canal and Provincetown, 1,500 telephones out of commission, and electric power disrupted for 12 to 18 hours in numerous towns on Cape Cod and Martha's Vineyard. Power, light, and telephone poles and wires collapsed.
Albion, Mont	20				2,500	Wind	Damage to buildings and haystacks.
Cut Bank, Mont	20					do	Winds of 70 m. p. h. with gusts of 100 m. p. h. disrupted telephone communications for about 2 hours.

SEVERE LOCAL STORMS FOR DECEMBER 1948—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Nebraska, western third	20		[1] 200			Dust and wind	Winds reached gale force, damaging wheat fields in some localities. Dust so thick that travel halted in vicinity of Oshkosh, Garden County.
Red Boiling Springs, Tenn.	24-25	4 a. m., 24th–7 a. m., 25th.				Ice	Sleet, freezing rain, and snow. Some damage to trees and telephone lines.
San Joaquin Valley floor, from Bakersfield south to Grapevine, Calif.	25-26	9 a. m. 25th to 6:30 p. m. 26th.	[1] 40		1,010,000	Wind and dust	Storm moved northwestward; path approximately 50 miles long. Damage to cotton and vegetables approximately $1,000,000. Most damage east of Highway 99, between Greenfield and Grapevine. Duststorm one of worst in history of Kern County; very few recorded in December. Greatest potential damage will result from mass movement of topsoil and loss of topsoil.
Colorado, eastern plains and extreme southwest.	28					Blowing snow and dust.	Strong winds drifted snow and eroded soil, damaging grain fields and slowing transportation.
Oconomowoc, Wis	28	12:45 p. m., C. S. T.		1		Snow and sleet	Man killed by passing train during sleet storm.
Kansas, northwestern portion.	28	All day	[1] 60			Blizzard	High winds and blowing snow, that totalled 2 to 4 inches blocked highways from western border eastward for about 150 miles. At Goodland, wind velocity reached 67 m. p. h. with gusts of 74 m. p. h. and zero visibility. 79 long-distance telephone circuits out, as result of an inch or more of ice on wires between Colby and Salina. No serious damage to livestock.
Nebraska, from southwest to northeast.	28		[1] 150			Ice, snow and driving snow.	Considerable glaze in central and northeast. Snow drifts blocked roads, interrupting travel. Some places without electricity for 2 days. Considerable damage to telephone and power wires.
Eastern and central Wisconsin.	28-29	Afternoon of 28th to morning of 29th.			300	Sleet, glaze, and snow.	Highways along Lake Michigan from Milwaukee northward to Sheboygan, and westward to central Wisconsin icy and slippery. Numerous power-line breaks along the Lake shore between Milwaukee and Sheboygan.
Minnesota, extreme southwest.	28-29	P. m. and a. m.				Ice, sleet, snow, and wind.	Some damage to overhead wire systems.
Iowa, northern half	28-29					Snow and ice	Rain and drizzle, freezing as it fell; highways hazardous. Precipitation turned to snow and accompanied by driving winds gave severe storm conditions, especially in northern 3 tiers of counties when up to 8 inches of new snow fell. Highways temporarily blocked in O'Brien and Sioux Counties and other roads snow packed or ice covered.
Milwaukee, Wis	29	Afternoon			23,000	Wind, rain and sleet	3 windows were blown in; 8 people injured due to slippery roads. 1 Piper Cub plane damaged by wind.
Southwestern Vermont, western Massachusetts, and western Connecticut.	29-31	7:45 a. m. 29th–31st.		2	$11,000,000	Rain	Heavy rain of record proportions, falling on frozen ground, caused flood conditions over an area approximately 4,500 square miles; counties of Bennington and Windham, Vt.; Berkshire and western portions of Hampshire and Hampden Counties, Mass.; Litchfield, Fairfield, and western Hartford Counties, Conn. Flood damage especially severe in North Adams, Mass., where 2 deaths from drowning, and 400 families evacuated. All major highways west of Springfield, Mass., cut off at some point by high water. Railroad traffic west of Greenfield, Mass., on the Boston & Maine suspended, as was service on New York Central Lines between Boston, Mass., and Albany, N. Y.
Venice-Sarasota area, Fla	30	Afternoon			2,500	Wind	Squall of local nature, with winds estimated as high as 60 m. p. h. occurred in connection with cold front; caused high seas. 3 small boats sunk near Venice. Freighter went aground. Sailing vessel rammed by steamer in Tampa Bay.
Lower Mohawk and middle Hudson River Valleys, N. Y.	31	All day				Rain and ice	Heavy rain, which froze as it fell, covered power and communication lines with a heavy deposit of ice. Accumulations on telephone wires ranged up to 2 inches in diameter. Both wires and poles broken, leaving 33,000 homes without electricity, and service of 23,500 telephones interrupted. Damage will run into millions of dollars.
Coastal sections, Massachusetts and Rhode Island.	31					Gales and high tides.	Easterly winds of gale force, accompanied by unusually high tides, caused widespread damage along New England coast from Point Judith, R. I., to Cape Ann, Mass. 5 Navy boats sunk or damaged at Quonset Point, R. I.
Jefferson County, Ohio	31					Wind	Smoke stack blown down at power substation, breaking high tension feeders.

[1] Miles instead of yards.

LATE STORM REPORTS FOR MARCH AND NOVEMBER 1948

[The table hereunder contains such data as were received concerning severe local storms that occurred during these months. A revised list will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Oxford (near), Lafayette County, Miss.	*March* 30	11 p. m.		0	10,000	Tornado	Struck small community of Yocona. Several residences, barns, and other outbuildings damaged; 1 barn set afire by lightning. Stored corn damaged by rain. No serious injuries to persons or livestock.
Colorado, extreme eastern portion.	*November* 17–21	3:30 p. m. on 17th—3 p. m. on 21st.		1	250,000	Blizzard	Temperature near 0° F., winds reached 70 m.p.h. Snow ranged from light to 8 inches; drifted to depths of 15 feet, resulting in halting of transportation for 24 to 72 hours. Some wind damage to buildings, equipment and winter grains, but heaviest losses to livestock killed and heavy shrinkage. One death by freezing at Springfield. Sedgwick, Logan, Phillips, Yuma, Kit Carson, Elbert, Lincoln, Cheyenne, Prowers, Baca, and Los Animas Counties affected.

SOLAR RADIATION DATA FOR DECEMBER 1948

[Solar Radiation Investigation Section, I. F. HAND, in Charge]

Explanation of Tables 1 and 2 and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the MONTHLY WEATHER REVIEW, vol. 72, No. 1, January 1944, p. 43. A list of pyrheliometric stations is given on page 45 of that issue. An explanation of the formula used in computing the air mass values for each station listed in Table 1 appears in vol. 75, No. 3, March 1947, p. 47.

TABLE 1.—*Solar radiation intensities during December 1948*

[Gram calories per minute per square centimeter of normal surface]

CLIMAX, COLO.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 3.24	2.59	1.94	1.29	*0.65	1.29	1.94	2.59	3.24		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2							1.43	1.32	1.24		
9	1.24	1.32	1.44				1.40	1.31	1.23		
12		1.37	1.46								
13							1.46	1.38	1.26		
14	1.29	1.36	1.46				1.42	1.34	1.26		
15								1.26	1.20		
29		1.40	1.48				1.42	1.26	1.20		
30							1.41	1.32	1.28		
Means	(1.26)	1.36	1.46				1.42	1.31	1.24		
Departures	+.03	+.02	+.02				−.01	.00	.00		

TABLE MOUNTAIN, CALIF.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 3.76	3.01	2.26	1.51	*0.75	1.51	2.26	3.01	3.76		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1				1.52							
2	1.21	1.29	1.39	1.51							
10				1.55							
24	1.29	1.38	1.47	1.59							
25				1.59							
28				1.56							
Means	(1.25)	(1.34)	(1.43)	1.55							
Departures	+.01	+.01	.00	+.02							

LINCOLN, NEBR.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 4.77	3.81	2.86	1.91	*0.95	1.91	2.86	3.81	4.77		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
1	0.70	0.81	0.98							4.8	5.6
2	.89	1.02	1.18				1.18	1.07	0.96	4.0	6.1
3	.88	.99	1.14				1.20	1.06	.94	5.1	6.4
4	.88	.99	1.12				1.14	.99	.90	5.6	6.9
7	.83	.98	1.11				1.13	1.00	.87	2.9	3.7
9	.92	1.02	1.18				1.18	1.02	.92	3.3	1.9
29	.98	1.09	1.24				1.29	1.18	1.06	2.6	2.6
30	.89	1.04	1.18				1.13	.92		1.2	2.9
Means	.87	.99	1.14				1.18	1.03	.94		
Departures	−.07	−.09	−.07				−.01	−.02	.00		

TABLE 1.—*Solar radiation intensities during December 1948*—Con.

BOSTON, MASS.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 4.96	3.96	2.97	1.98	*0.99	1.98	2.97	3.96	4.96		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2	0.80	0.92								4.4	4.2
7		.88	.82							4.4	3.7
13		.81	.98							8.4	4.2
14	.91		1.12							4.8	3.3
17	.41	.66								6.4	6.4
20		.70								3.7	3.5
21	.75	.79								3.0	3.7
23	.62									4.4	4.2
Means	.70	.79	.97								
Departures	−.02	−.05	−.02								

MADISON, WIS.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 4.81	3.84	2.88	1.92	*0.96	1.92	2.88	3.84	4.81		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2	0.50	0.64	0.81		1.22		0.76			4.0	5.3
3	.64	.76	.91		1.47		.95			4.6	6.1
7	.98	1.02	1.19		1.60		1.21			2.9	2.9
9	.84	.98	1.03							2.0	2.2
13	.32		.57							4.0	5.1
16	.88	1.03	1.15		1.46		1.11			4.2	3.3
17	.92	1.03	1.14							2.5	2.3
21	.92									5.6	5.3
22	.99	1.03	1.16		1.52					1.7	2.5
23	.88	1.01	1.15		1.53					1.5	2.0
30	1.04	1.11	1.22		1.57		1.25			1.8	2.7
Means	.81	.96	1.03		1.48		1.06				
Departures	−.09	−.06	−.14		−.03		−.13				

BLUE HILL, MASS.

Date	Sun's zenith distance A.M. 78.7°	75.7°	70.7°	60.0°	0.0°	P.M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure 7:30 a.m.[1]	1:30 p.m.[1]
	Air mass 4.86	3.89	2.92	1.94	*0.97	1.94	2.92	3.89	4.86		
December	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mb.*	*mb.*
2	1.05	1.14	1.22							4.2	4.0
7	.85	.91								3.8	4.1
11	.98	1.12	1.24							3.1	2.7
13	.80	.91	1.00				1.16	1.05	0.96	7.9	4.3
14	1.02	1.12	1.24				1.23	1.09	.98	4.4	3.7
18	.96	1.07	1.18				1.24	1.06	.90	3.1	2.6
20	.95	1.05	1.13							3.1	3.0
21	.84	.91	.92							2.6	3.0
22	.69	.85	1.05				1.01	.91		4.4	5.1
23	.87	.93	1.07				1.14			4.0	4.5
24	.91	1.07	1.22				1.29	1.14	1.04	2.2	1.4
26	.97	1.08	1.31				1.34	1.21	1.10	1.0	1.1
28							.79	.61	.50	2.1	4.0
Means	.91	1.01	1.14				1.15	1.01	.91		
Departures	+.01	−.03	−.03				.00	−.03	−.05		

* Extrapolated.
[1] 75th Meridian Time.
Note.—Figures in parenthesis are interpolated.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct + diffuse) received on a horizontal surface during December, 1948*

[Gram-calories per square centimeter]

Date	Washington, D. C.	Madison, Wis.	Lincoln, Nebr.	New York, N. Y.	Fresno, Calif.	Columbia, Mo.	Boston, Mass.	Nashville, Tenn.	Twin Falls, Idaho	La Jolla, Calif.	Riverside, Calif.	Blue Hill, Mass.	Newport, R. I.	Salt Lake City, Utah	Put-in-Bay, Ohio	State College, Pa.	Davis, Calif.	Toronto, Canada	Ithaca, N. Y.	E. Wareham, Mass.	Honolulu, T. H.	Pearl Harbor, T. H.	East Lansing, Mich.	Summit, Mont.	Soda Springs, Calif.	Grand Lake, Colo.	Inyokern, Calif.
1948	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
December 3	42	195	235	27	89	204	50	68	74	199	257	80	58	58	186	47	250	121	62	76	446	446	126	70	67	277	264
December 4	205	188	230	79	270	229	63	262	204	260	292	84	54	145	207	225	218	122	107	60	482	415	131	91	191	164	322
December 5	176	75	119	193	86	57	140	22	73	268	258	160	197	----	29	152	20	61	97	185	471	439	8	77	17	170	308
December 6	187	188	132	54	161	119	1	278	134	155	271	9	31	148	178	202	72	29	34	37	508	445	66	88	262	178	300
December 7	197	203	236	140	193	254	144	214	67	254	269	196	159	102	170	207	43	130	104	178	483	381	118	77	56	189	300
December 8	179	113	72	156	48	87	112	301	203	257	236	132	149	212	145	192	165	84	45	139	419	396	56	98	253	130	301
December 9	140	146	255	115	197	84	99	257	161	252	276	123	130	209	200	201	128	155	42	126	276	322	90	66	202	200	305
Means	161	158	183	109	149	148	87	194	131	235	266	112	111	146	160	175	128	100	70	114	441	406	85	81	150	187	300
Departures	+1	+41	+11	−15	−32	+5	−7	+60	+9	−3	+42	−22	−24	−6	+45	+47	−42	+13	−25	−19	+9	+26	0	+4	−16	----	----
December 10	171	133	181	173	48	250	92	265	132	246	261	101	124	176	89	86	217	133	71	85	393	300	23	49	240	116	303
December 11	181	146	131	131	160	190	129	200	99	171	181	156	162	53	114	154	175	66	68	141	442	462	110	101	150	74	238
December 12	33	188	185	34	238	230	36	67	50	176	256	55	39	128	39	65	47	19	14	64	462	419	20	45	(25)	230	217
December 13	202	154	156	191	221	235	156	32	101	183	118	197	208	70	42	204	73	58	98	179	486	314	16	141	(32)	258	251
December 14	173	67	22	205	177	28	166	49	142	194	261	220	219	59	141	218	189	111	107	199	476	327	69	86	66	229	278
December 15	5	35	39	22	188	155	58	45	201	260	290	86	59	156	14	12	71	12	10	73	508	432	1	72	213	116	274
December 16	22	183	217	13	114	264	6	30	188	66	128	27	45	235	139	19	34	81	16	43	494	439	118	90	35	165	295
Means	112	129	133	110	164	193	92	98	130	185	214	120	122	125	83	108	115	61	55	112	466	385	51	83	109	170	265
Departures	−28	+11	−28	−8	−3	+43	−33	−26	+2	−47	+2	−21	−26	−3	−20	−4	−45	−13	−54	−40	+19	+5	−43	−2	−35	----	----
December 17	210	170	134	158	106	256	113	173	160	145	119	146	164	72	56	78	93	81	19	115	458	408	82	106	----	83	177
December 18	144	62	50	210	50	30	148	30	210	258	276	197	209	180	76	100	246	99	60	197	447	410	33	72	----	102	309
December 19	22	70	152	22	46	69	3	24	124	275	257	31	26	138	112	55	229	23	23	28	373	293	102	54	----	83	310
December 20	105	67	129	106	36	205	124	254	115	190	202	181	192	48	74	139	33	41	87	----	382	310	610	71	177	57	308
December 21	164	128	174	55	50	260	72	224	202	161	148	133	128	134	200	148	233	9	27	121	387	240	91	69	154	47	203
December 22	156	209	163	176	125	188	154	174	178	50	69	186	186	136	85	210	107	89	98	172	461	356	63	146	(256)	70	197
December 23	87	192	40	192	268	22	160	127	82	259	160	192	199	116	179	132	258	163	70	193	390	397	122	142	242	72	317
Means	127	128	120	132	98	147	111	144	153	191	180	152	158	118	111	123	171	72	55	133	414	345	79	94	207	73	260
Departures	−22	+5	−49	+19	−44	−28	0	−9	+36	−31	−32	+13	+17	−14	−5	−5	+56	−2	−42	−21	−14	−13	−24	−2	+30	----	----
December 24	103	186	60	225	251	58	185	19	211	267	267	221	225	334	93	172	159	99	73	205	276	241	92	140	268	177	305
December 25	63	226	216	66	246	255	107	196	206	158	280	129	123	253	228	167	24	185	89	99	498	448	164	145	156	270	287
December 26	242	209	182	233	55	266	188	264	142	208	179	231	230	258	206	243	10	149	83	208	421	377	160	168	29	266	266
December 27	230	58	198	179	147	140	108	236	121	200	145	151	163	32	134	198	112	80	36	118	496	400	20	165	174	251	287
December 28	200	26	49	150	259	11	96	43	170	272	292	132	171	12	127	194	162	43	40	145	430	354	57	88	276	131	305
December 29	15	106	251	29	94	11	27	135	150	237	262	52	64	159	63	14	65	2	16	83	385	264	3	(35)	234	280	276
December 30	7	219	248	18	25	255	30	19	210	131	131	39	49	206	15	22	162	23	T	64	395	317	139	118	210	207	165
December 31	107	172	246	31	108	63	10	224	173	136	159	13	18	98	248	53	37	54	20	36	452	459	184	51	137	180	241
Means	121	150	181	117	148	132	94	141	173	213	214	121	130	168	139	133	104	91	51	120	419	358	102	114	185	220	266
Departures	−23	+34	+21	−4	+8	+5	−5	+48	+42	−10	+6	−5	−3	+28	+48	+33	−17	+8	−43	−12	+15	0	+26	+24	+27	----	----

ACCUMULATED DEPARTURES ON DECEMBER 31, 1948

	−7784	+7931	+5964	−7063	+12761	{ }	−4816	{ }		−6888	{ }	−6496	−616	−476	{ }	−1904	−3060	+1750	−26021	−2734	{ }		−1575	{ }			

PERCENTAGE DdepartureS FOR THE YEAR

	−6.3	+6.6	+4.5	−6.3	+7.8		−4.6			−4.6		−5.3	−0.5	−0.3		−1.7	−1.9	+1.7	−24.8	−2.3			−1.5				

TABLE 3.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing south at Blue Hill, Mass., during December 1948*

Date	3	4	5	6	7	8	9	Mean	10	11	12	13	14	15	16	Mean
Gm cal/cm²	45	56	285	7	458	258	175	183	118	295	56	481	519	109	10	227

Date	17	18	19	20	21	22	23	Mean	24	25	26	27	28	29	30	31	Mean
Gm cal/cm²	267	487	13	402	228	455	480	333	603	134	657	258	251	32	21	6	245

LATE REPORTS OF SOLAR RADIATION

TWIN FALLS, IDAHO

Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface

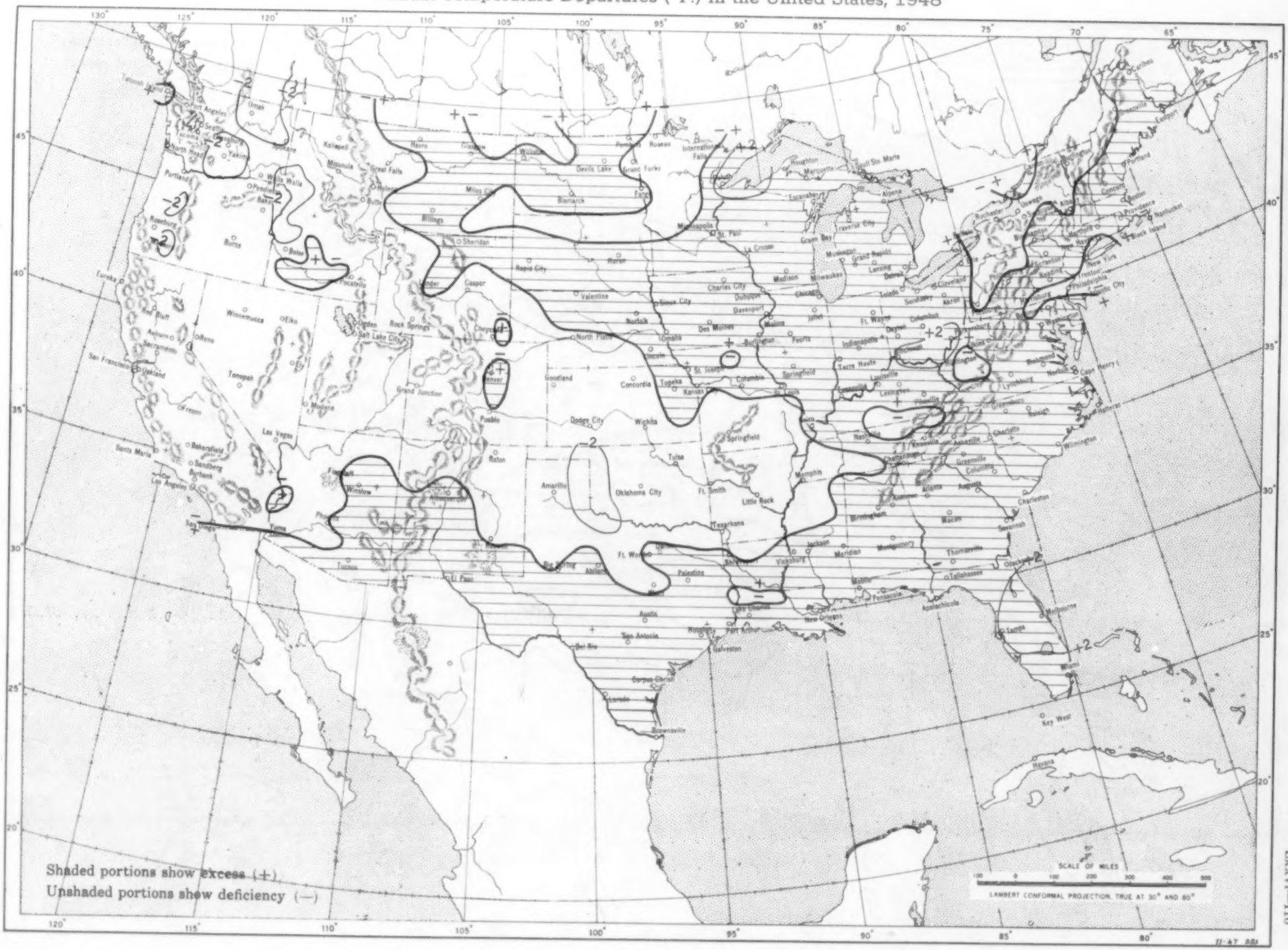
[Gram calories per square centimeter]

Oct. 29	190
Oct. 30	289
Oct. 31	145
Nov. 1	84
Nov. 2	277
Nov. 3	189
Nov. 4	295
Mean	210
Nov. 5	247
Nov. 6	81
Nov. 7	209
Mean (Nov. 5-11)	200

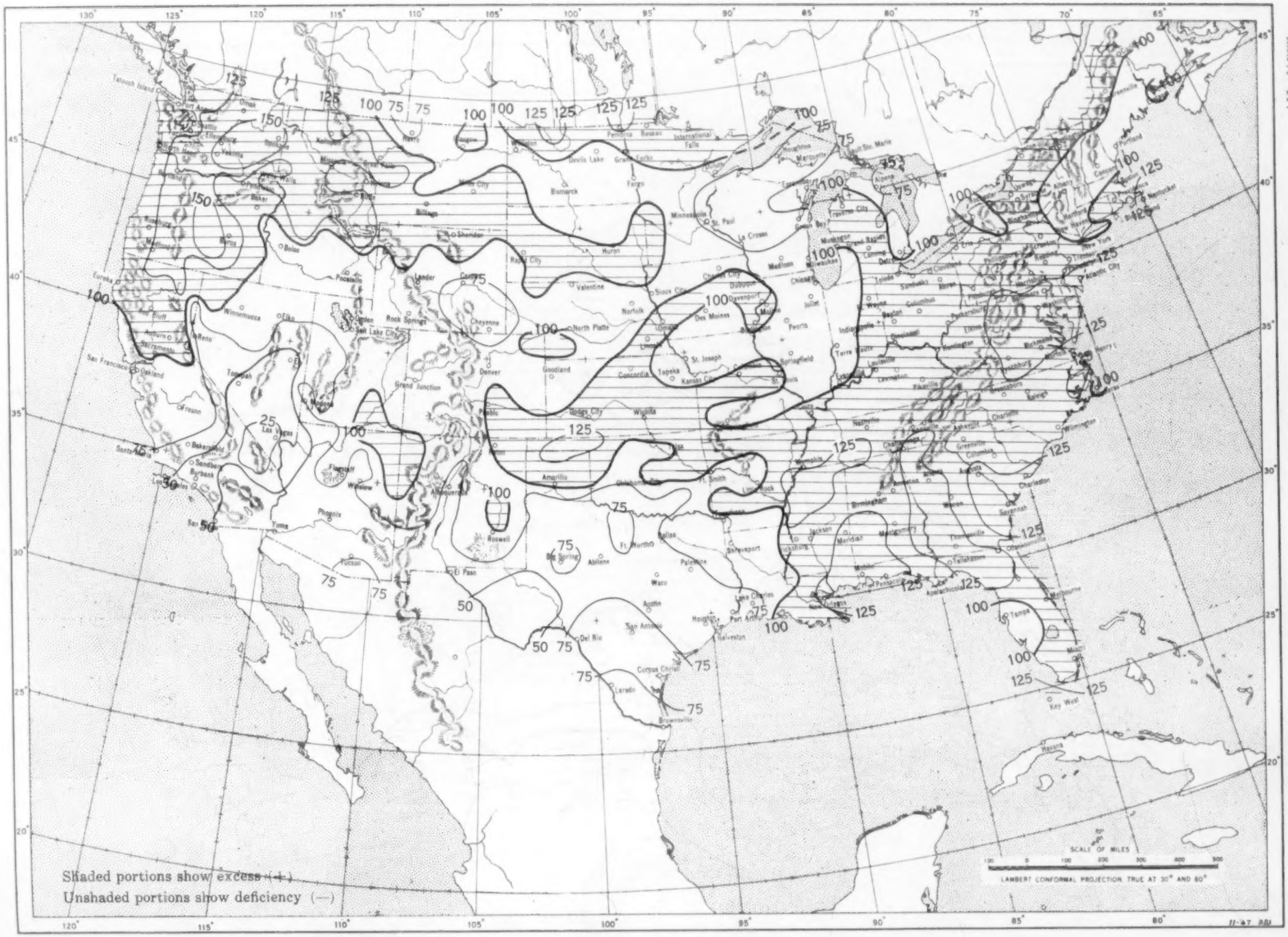
Note.—The Weather Bureau receives frequent inquiries about sunspot data formerly published in the MONTHLY WEATHER REVIEW. Therefore, the following note is reprinted for the information of readers who may have overlooked the original notice in the December 1947 issue of the REVIEW:

Publication of "Positions, Areas, and Counts of Sunspots" in the MONTHLY WEATHER REVIEW will be *discontinued* with the December 1947 issue. The data will be issued thereafter through publications of the U. S. Naval Observatory at various times, depending on the sunspot activity. Current data will be distributed monthly to a limited number of persons on request addressed to Superintendent, U. S. Naval Observatory, Washington 25, D. C.

Annual Temperature Departures (°F.) in the United States, 1948

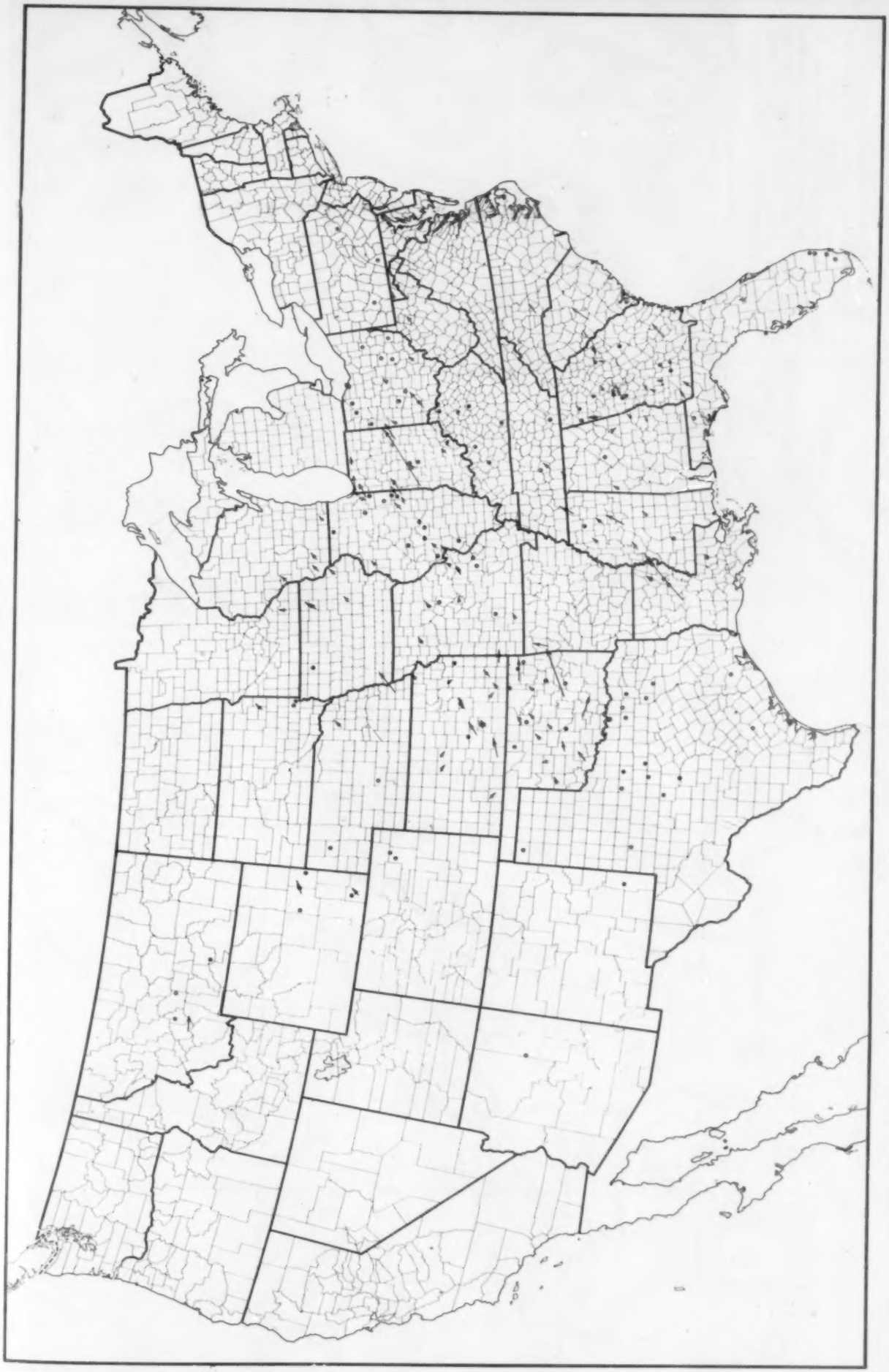

Shaded portions show excess (+)
Unshaded portions show deficiency (−)
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Percentage of Normal Annual Precipitation in the United States, 1948


Shaded portions show excess (+)
Unshaded portions show deficiency (—)
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Tracks of Tornadoes during 1948

Tracks of Tornados during 1948



Dots show location of tornadoes where tracks are too short to indicate on chart.

Tracks of North Atlantic Hurricanes and Tropical Disturbances of 1948

Tracks of North Atlantic Hurricanes and Tropical Disturbances of 1948

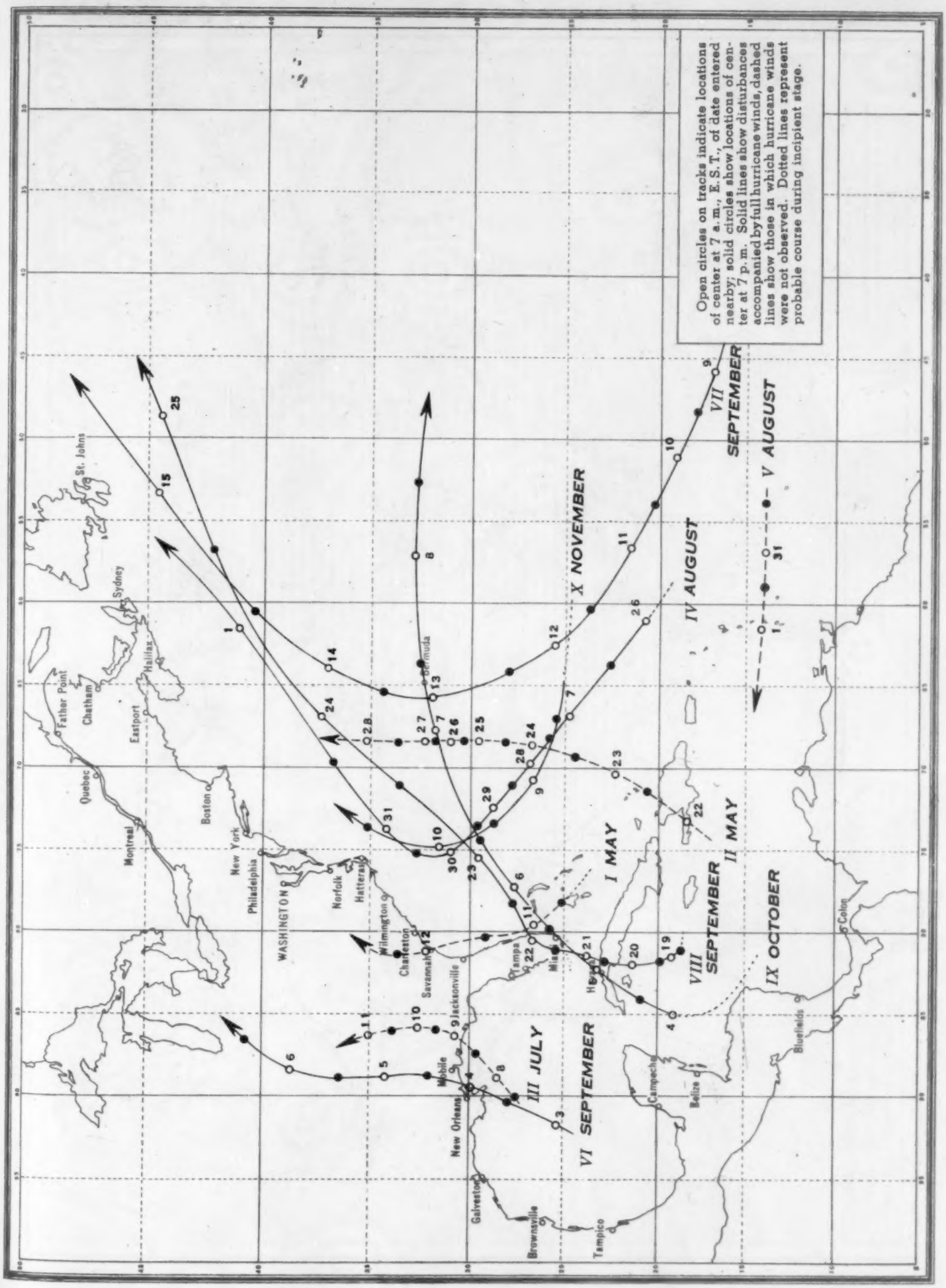


Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, December 1948

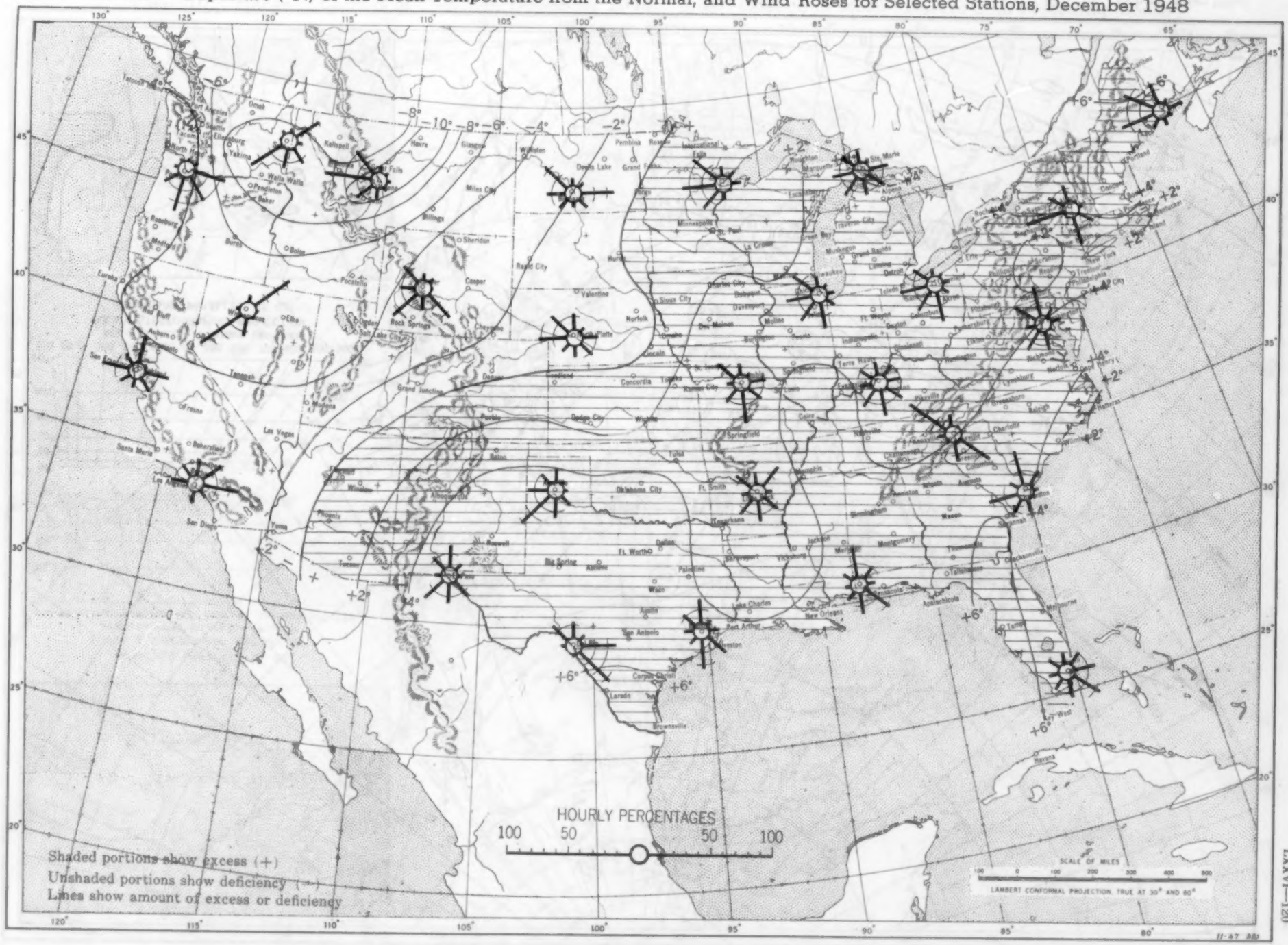
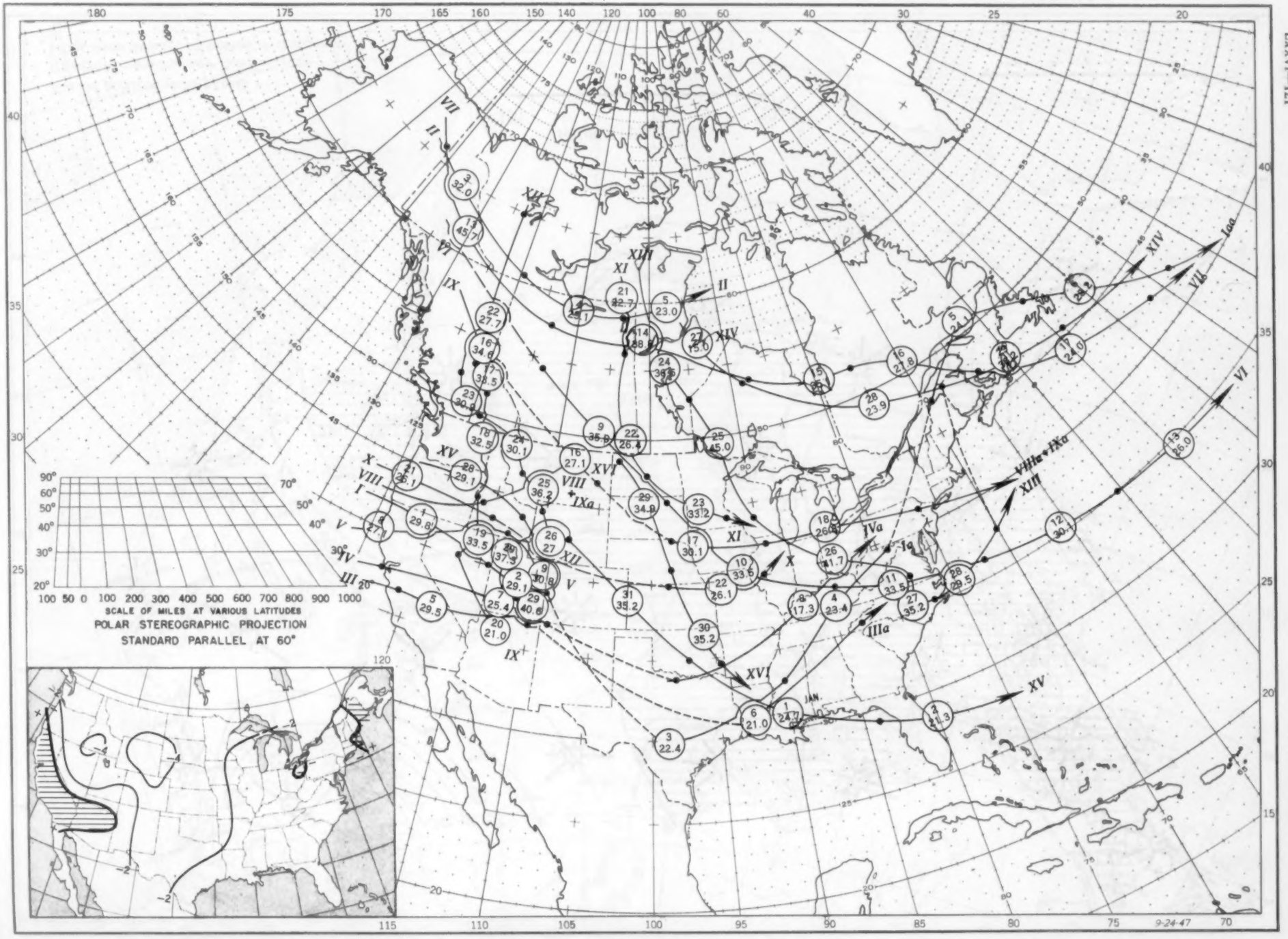

HOURLY PERCENTAGES
100 50 50 100
Shaded portions show excess (+)
Unshaded portions show deficiency (−)
Lines show amount of excess or deficiency
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

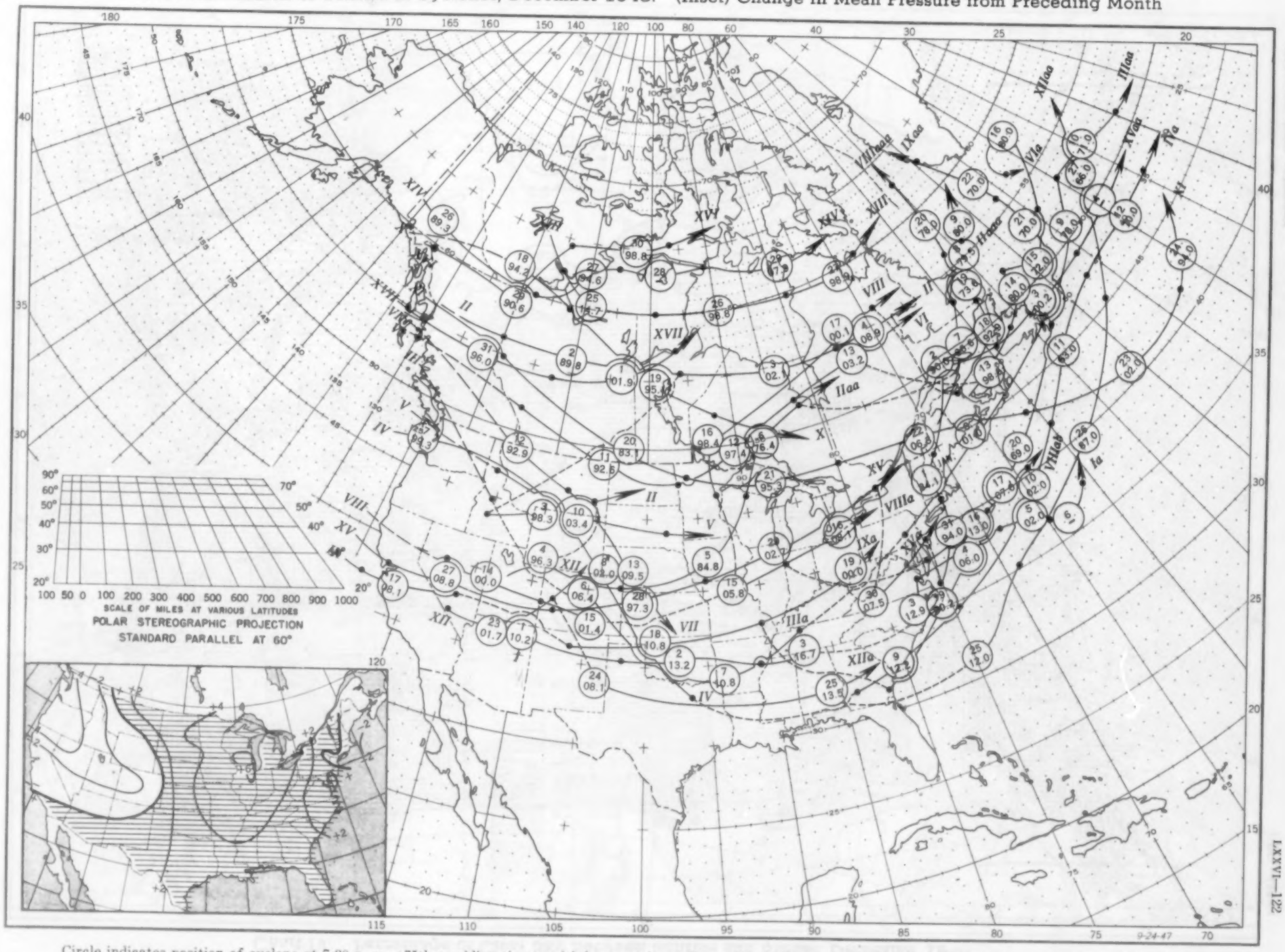
Chart II. Tracks of Centers of Anticyclones, December 1948. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time)

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time)

Chart III. Tracks of Centers of Cyclones, December 1948. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time)

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset. December 1948

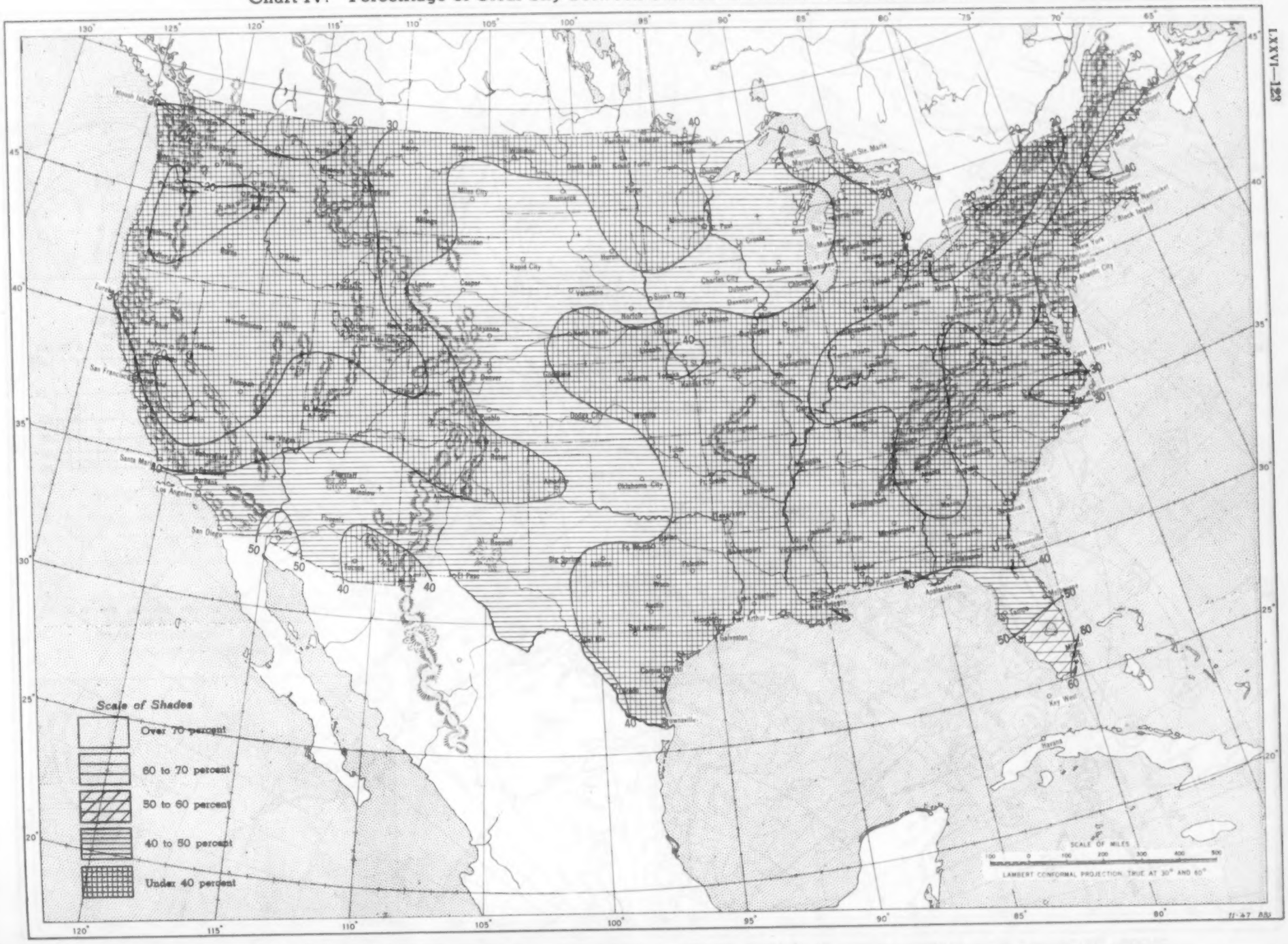

Scale of Shades
Over 70 percent
60 to 70 percent
50 to 60 percent
40 to 50 percent
Under 40 percent
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart V. Total Precipitation, Inches, December 1948. (Inset) Departure of Precipitation from Normal

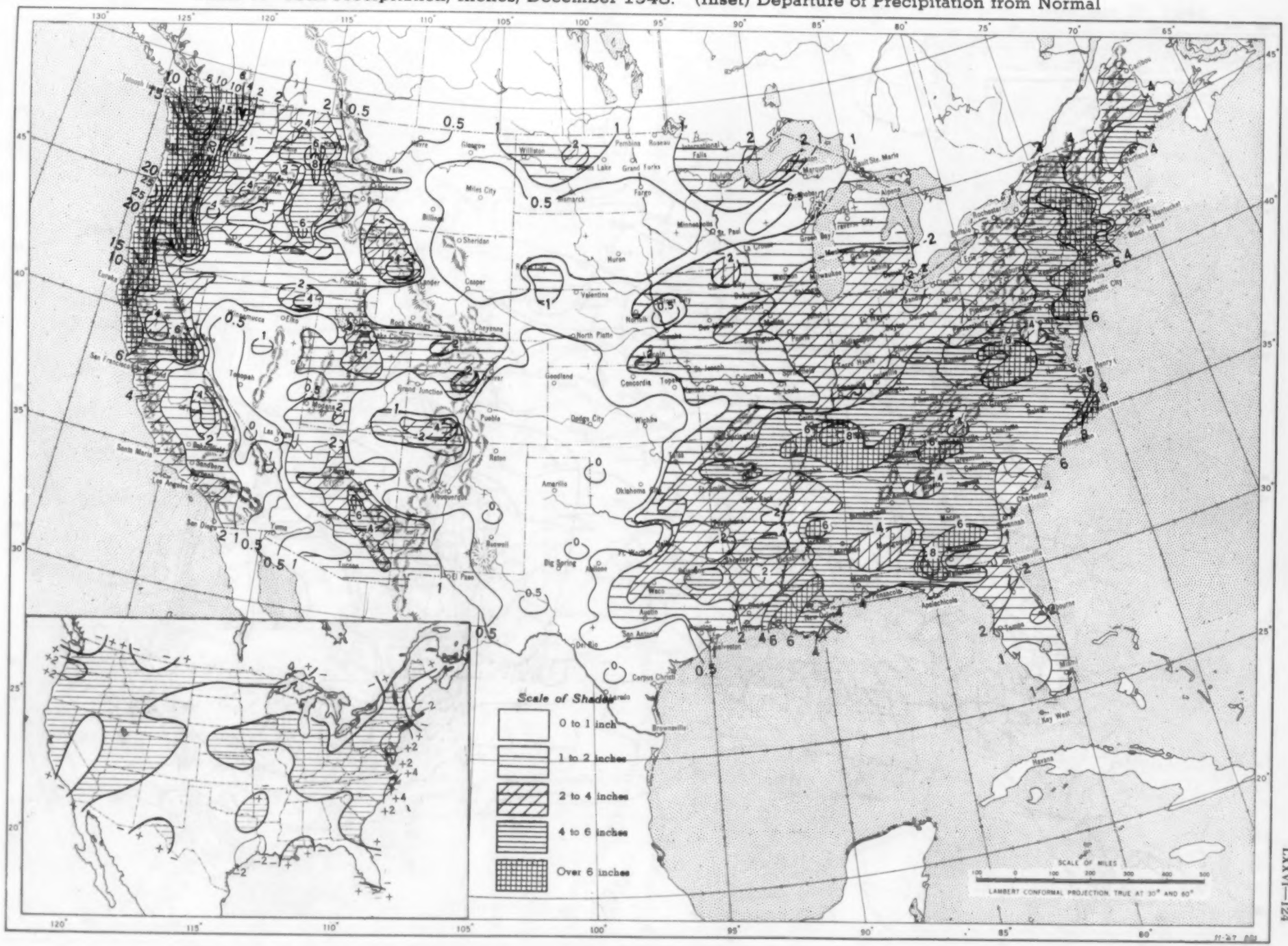

Scale of Shades
0 to 1 inch
1 to 2 inches
2 to 4 inches
4 to 6 inches
Over 6 inches
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart VI. Isobars (mb.) at Sea Level and Isotherms (°F.) at Surface; Prevailing Winds, December 1948

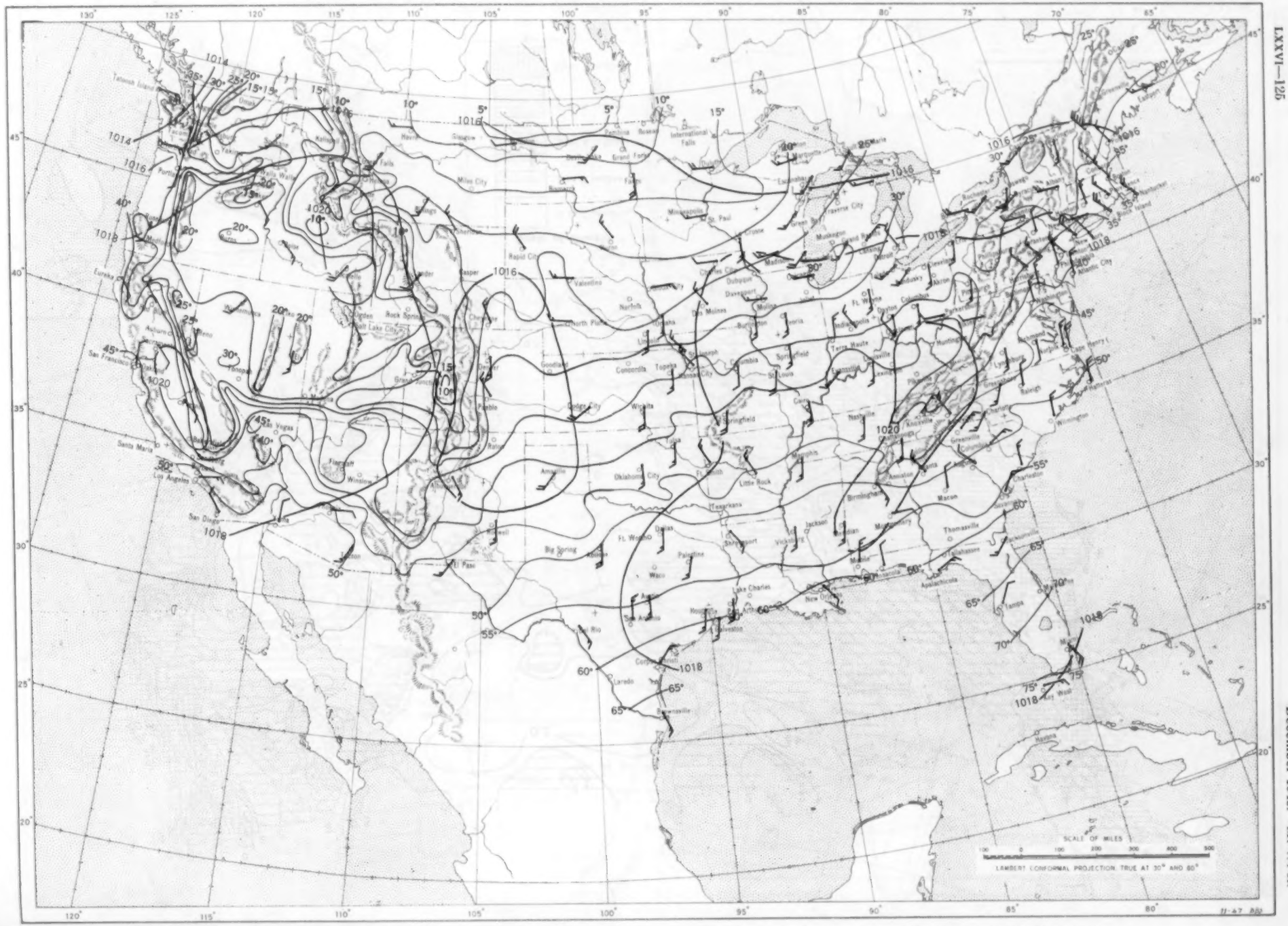


Chart VII. Total Snowfall, Inches, December 1948. (Inset) Depth of Snow on the Ground at 7:30 p. m., December 28, 1948

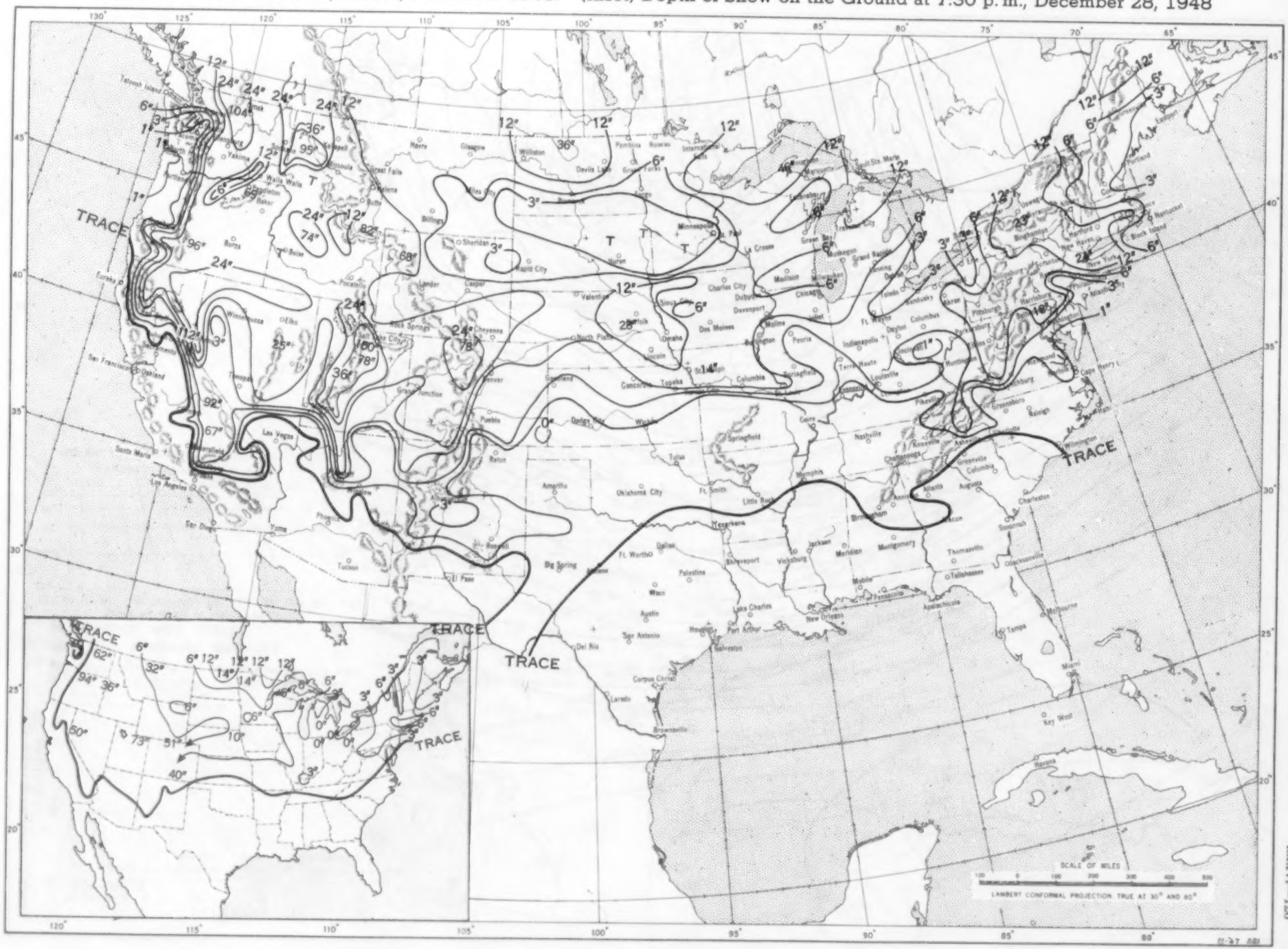
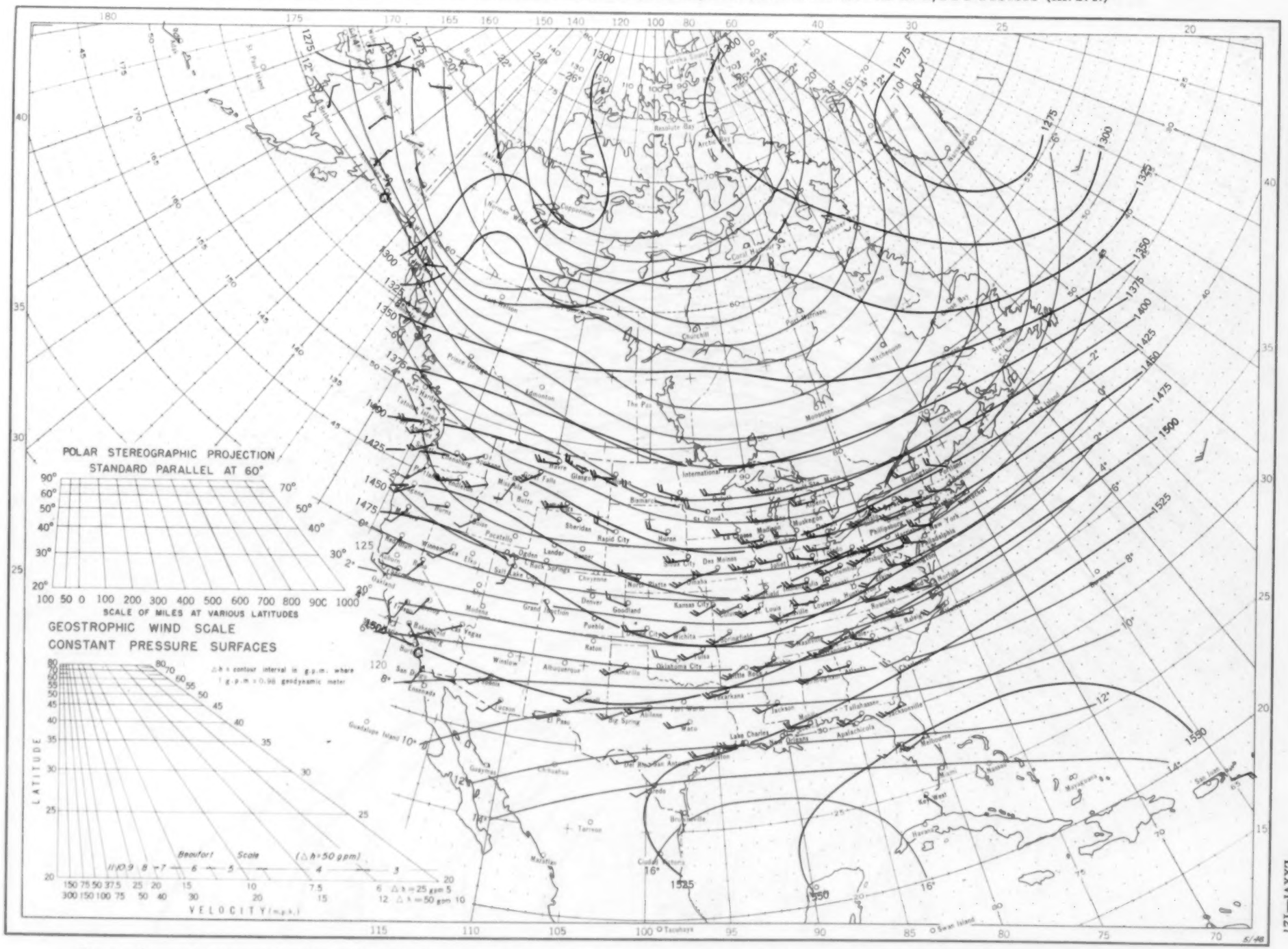


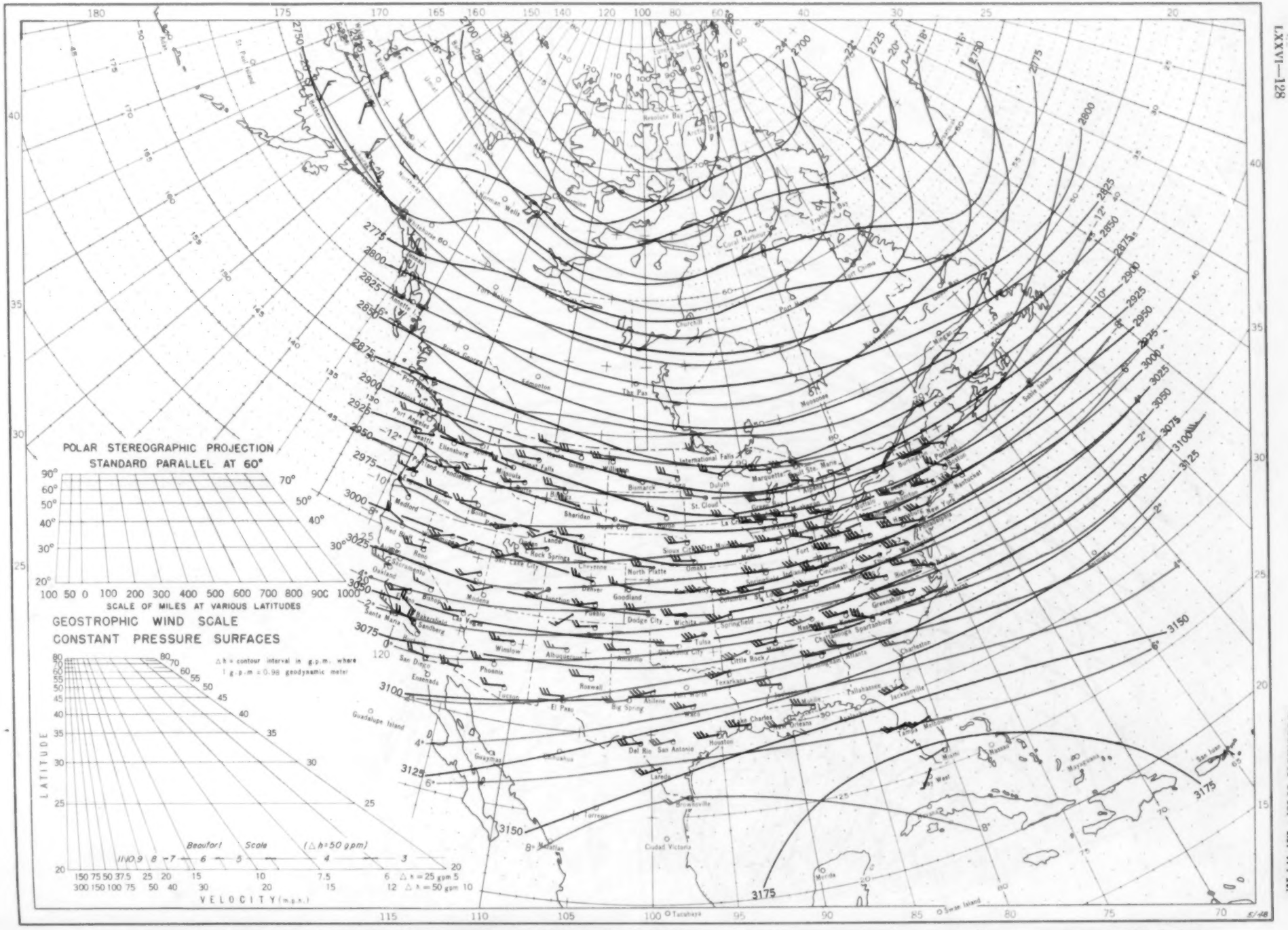
Chart VIII, December 1948. **Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in**

Chart VIII, December 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)


POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°
SCALE OF MILES AT VARIOUS LATITUDES
GEOSTROPHIC WIND SCALE
CONSTANT PRESSURE SURFACES
LATITUDE
VELOCITY (m.p.h.)
Beaufort Scale
△h = contour interval in g.p.m. where 1 g.p.m. = 0.98 geodynamic meter

Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart IX, December 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)

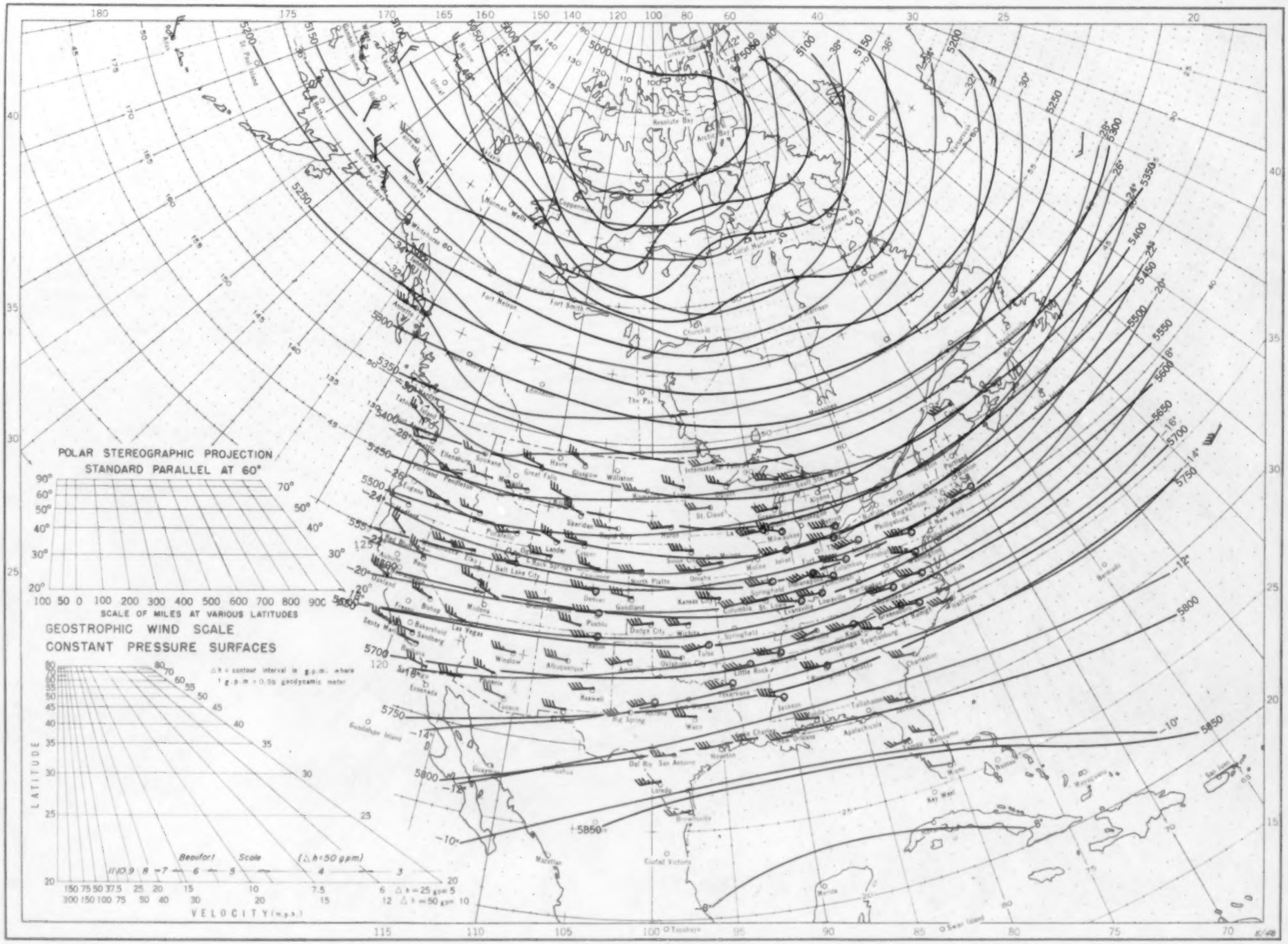


Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart X, December 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in

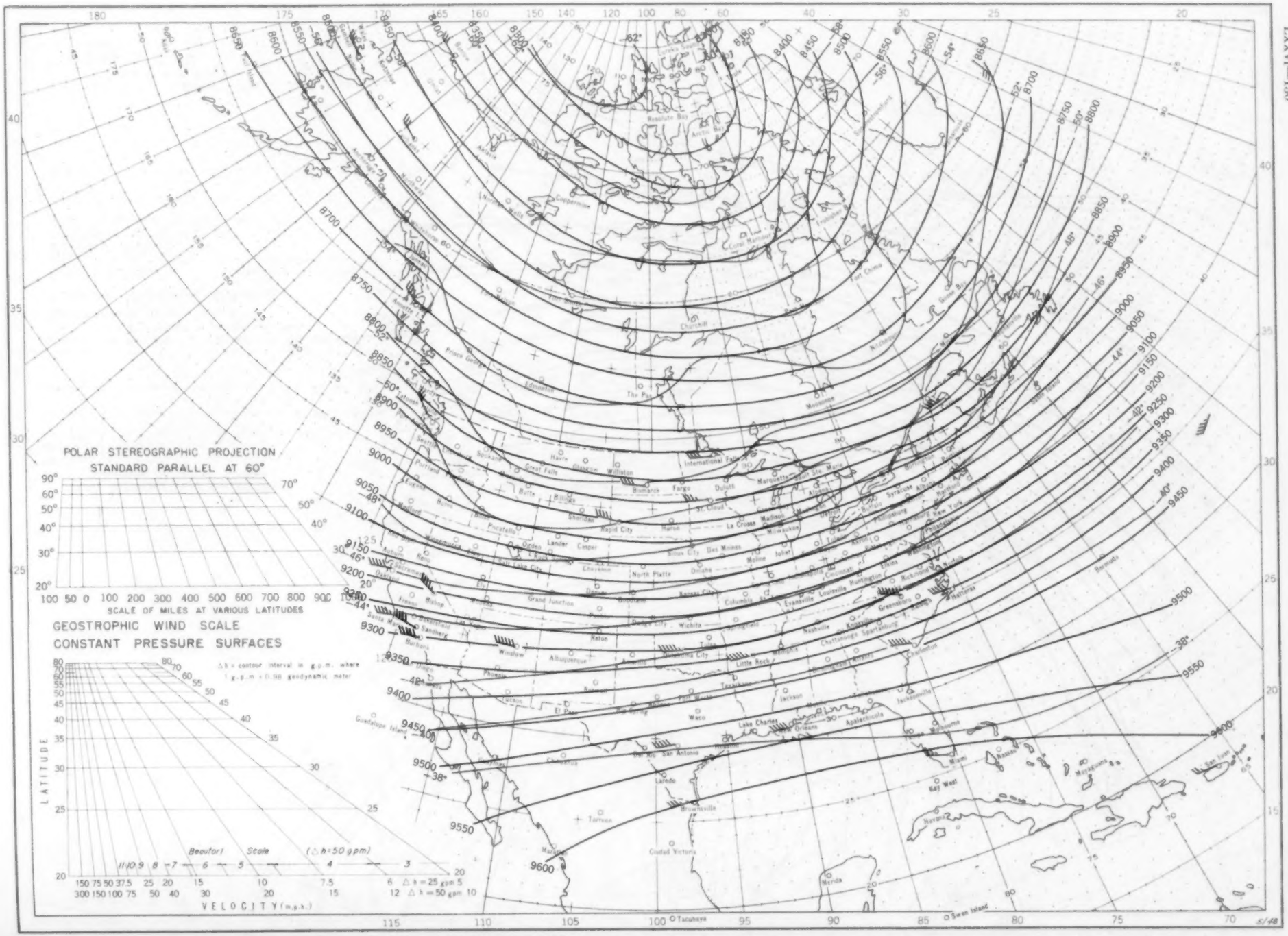
those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart X, December 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)


POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°
SCALE OF MILES AT VARIOUS LATITUDES
GEOSTROPHIC WIND SCALE
CONSTANT PRESSURE SURFACES
LATITUDE
VELOCITY (m.p.h.)
Beaufort Scale
Δh = contour interval in g.p.m. where 1 g.p.m. = 0.98 geodynamic meter

Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart XI, December 1948. Contour Lines of Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

those indicated by red arrows based on rawins taken at 0300 G. C. T.

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